PB-229 434

A PRELIMINARY ECONOMIC BASE STUDY OF THE ANIMAS-LAPLATA PILOT PROJECT WATERSHEDS IN THE FOUR CORNERS AREA OF THE COLORADO RIVER BASIN

Kenneth C. Nobe, et al

Public Health Service
Denver, Colorado

July 1962

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PREFACE

This report was prepared as part of a pilot study of the Animas-LaPlata drainage area. This overall effort serves as a means of developing methodology and staff experience for later use in the overall comprehensive water quality management planning phase of the Colorado River Basin Project.

After internal review by interested personnel within the Public Health Service, the final draft of this report will be provided to the Associated Rocky Mountain Universities and the Economic Research Service, U. S. Department of Agriculture, for use as a guide in preparing a series of economic base studies for the major sub-basins of the Colorado River drainage system. We wish to provide them with the best possible product, not only in regard to the presentation of economic data in report form but also in terms of demonstrating an approach which will be useful in translating these results into terms of their effects on water quality. Review comments should therefore be oriented to an examination of the methodology, particularly the applicability of the inter-industry input-output approach, and to providing suggestions as to how subsequent efforts in developing economic base studies, specifically designed for use in comprehensive water quality management efforts, can be improved.

Kenneth C. Nobe
Senior Project Economist

FOREWORD

COLORADO RIVER BASIN WATER QUALITY CONTROL PROJECT
Public Health Service

BACKGROUND AND OBJECTIVES

The Colorado River Basin Water Quality Control Project was initiated by the Public Health Service at the request of the water pollution control agencies of the seven Basin States at a conference called by the Surgeon General in Phoenix, Arizona, January 13, 1960, under the provisions of Section 8, Public Law 660, 84th Congress, the Federal Water Pollution Control Act. The Project is consequently operating under the interstate enforcement provisions of the Act and is directed toward the accomplishment of the following objectives:

1. A determination of the specific pollutants and their concentrations which now exist or which may reasonably be expected to exist in the immediate future resulting from various water uses within the Basin, and the establishment of priorities for developing data on, and securing needed remedial action at the most critical and pressing problem areas.

2. A determination of methods for securing the best possible water quality for multiple water use and the development of a comprehensive plan and program of water quality control for multiple water use within the Basin which can serve as a guide for the conference and to State and Federal agencies having an interest in the prevention and control of water quality degradation.

Under the conference mechanism the official conferees consist of a representative of the Public Health Service and the water pollution control agencies of each of the States involved. The conferee group associated with this enforcement action is as indicated on the cover of this report.

ORGANIZATION

The Project Headquarters office, consisting of engineering and associated professional and clerical personnel, is located in Denver, Colorado. A laboratory for the sanitary analysis of samples collected has been established in Salt Lake City, Utah, and will provide the facility for radiological, bacteriological, biological, and chemical analyses of the various samples collected.

The Project is administratively attached to the Water Supply and Pollution Control program of the Public Health Service, Department of Health, Education, and Welfare, Region VIII, Denver, Colorado. The Water Supply and Pollution Control programs in DHEW Region VII, Dallas, Texas, and DHEW Region IX, San Francisco, California, are also cooperating with the Project, since portions of these regions lie in the Colorado River Basin.

ACKNOWLEDGMENT

A special note of appreciation is tendered to the many individuals who have contributed to the successful completion of this study. Assistance in the form of basic data, methodology, and helpful suggestions was obtained from a wide variety of sources including local residents of the study area, personnel of numerous Federal and state governmental agencies, and researchers in several universities.

The authors are particularly grateful to those persons listed below for their assistance in various phases of the study:

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Mr. Dwight E. Neill, Director of Resources and Community Development, Colorado Department of Employment, and Mr. Ronald Lemon of his staff, Denver, Colorado

Mr. Justus K. Smith, Chief of Planning and Development, Colorado State Planning Division, and Mr. Marshall Hoffman of his staff, Denver, Colorado

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Mr. John G. Welles, Head, Industrial Economic Division, Denver Research Institute, University of Denver, Denver, Colorado

SUMMARY OF FINDINGS

The 2,019 square mile drainage area of the Animas and LaPlata watersheds includes most of San Juan and LaPlata Counties, Colorado and a small portion of San Juan County, New Mexico. Analysis is limited to that portion of these two watersheds lying in Colorado because applicable trend data for the San Juan County, New Mexico portion was not available.

This report deals with an evaluation of the area's present economy and a projection of the most probable growth path to the year 2010. The technical reader will quickly note its weaknesses as well as its strong points upon examination of the procedures, data, and analyses which it contains. The nontechnical reader, however, may have difficulty in evaluating the reliability and applicability of the various estimates. For his benefit it may be said that in general the more detailed projections are likely to be less accurate than the more aggregate forecasts. Likewise, projections for 2010 and 1980 are subject to greater error than those for 1965. The only basis for including the long range estimates, as a matter of fact, is to provide some general order of magnitude for the expected growth of the economy during a period sufficiently long enough to initiate water resource development projects and to allow for a period in which they would be expected to provide benefits at least equal to costs of development.

Conditions in the study area are too diversified to allow adequate coverage of these variations in summary form. The remarks that follow, therefore, take into account only a few of the major findings of this study.

Overall rate of population growth in the study area has been rapid in recent years. The recent accelerated trend traces its origin to the early 1950's when major expansion of the oil and gas industry was initiated in the Four Corners area. Population increased from 9,358 in 1900 to 16,313 in 1950 followed by a comparatively rapid rise to 20,074 in 1960. It is expected to increase to 24,000 by 1965, to 32,500 in 1980 and to 43,000 in 2010. Urban population has increased from approximately a third of the total area population in 1940 to about 55 percent in 1960. This portion of the population is expected to increase to 71 percent by 2010.

The major resource-oriented industries of the study area, in order of their importance in generating realized personal income in 1960, were: 1) Minerals-mining and processing; 2) Recreation (as reflected in retail trade and services); 3) Manufacturing; and 4) Agriculture. Respectively, they accounted for 22.5 percent, 9.8 percent, 6.9 percent, and 5.7 percent, or a total of 44.9 percent of realized personal income. A gradual reorientation in importance of these industries is expected during the 50-year projection period. By 2010, they are estimated to make the following relative contributions to generation of local realized personal income: Minerals, 21.6 percent; Recreation 17.7 percent, Manufacturing 17.5 percent, and Agriculture 1.8 percent, or a combined total of 58.6 percent.

Changes in the relative importance of the various industries, including both basic and secondary sectors of the economy, are expected to result in a major reorientation in employment of the area's labor force. The five leading sectors of the economy in 1960, in terms of their work force, accounted for 68 percent of the total labor force. These were distributed as follows:

Services 17.8 percent; Retail Trade 17.7 percent; Minerals 11.1 percent; Government 10.9 percent; and Agriculture 10.5 percent. By 2010, the percentage of the labor force employed in the five sectors listed above is expected to increase to approximately 75 per cent and to be distributed as follows: Services 18.4 percent; Retail Trade 17.7 percent; Minerals 19.1 percent, Government 15.0 percent; and Agriculture 5.3 percent. Manufacturing employment as a percentage of the total labor force is expected to decline from 4.9 percent in 1960 to 4.2 percent by 1965, to 3.5 percent in 1980 and then to increase to 6.6 percent by 2010.

Gross regional product (production of goods and services) was estimated to be approximately 38.2 million in 1960. It is expected to increase to $49.4 million in 1965, to $91.0 million in 1980, and to $182 million in 2010. Realized personal income was estimated at approximately $33 million in 1960 and is expected to increase to $39.4 million in 1965, to $82.3 million in 1980 and to $129.0 million in 2010.

The summary of economic projections presented above cannot be expected to be an exact representation of the economic environment of the study area as it will appear 50 years from now, or even 10 or 5 years in the future. Possible variations in the projected growth path can result from a number of unforseen factors. Barring major wars or depressions, however, the following three factors are likely to have the greatest influence on how the local economy will actually develop during the next few decades: 1) Changes in the national economy affecting the study area's competitive position in the production of goods and services; 2) The future sequence of development of various industries in the local area; and 3) Water quantity and quality constraints, within which the actual framework of water resource management will be practiced in the area.

The relative change in importance of the major industries projected in the "most probable growth path" have major significance in regard to how the area's water resources are to be managed. Agriculture, for example, is presently a major water user and a known contributor to pollution. (An increase in salinity in the Animas River below Durango, for example, is partly due to irrigation return flows.) Agriculture is expected to move from a present position of major importance to one of contributing less than 2 percent of the area's total realized personal income by 2010. The recreation industry, requiring relatively high water quality standards, is expected to become the most important single sector of the economy by 2010 (although if oil and gas are considered along with other minerals, this is larger), closely followd by manufacturing. Since manufacturing is expected to be oriented primarily to petro-chemical industries, this too has a major implication in the future water quality of the study area.

The combined effects of the major sectors of the projected economy on the quantity and quality aspects of the area's water supply casts some doubt as to whether the projected growth path can materialize at all. Whether or not water quantity and/or quality will become constraints to the area's future economic growth was not included within the scope of this report. It is hoped, however, that it contains the information needed to determine whether or not such constraints are likely to occur and if so, to assist in the development of a management program which will minimize their impact.

The most significant finding of this study effort, in the opinion of the authors, falls within the general area of "sharpening" the tools of economic analysis as applied to water quality management programs. Use was made of an inter-industry, input-output approach for determining both the direct and secondary effects of each sector of the economy on the overall production of goods and services, as well as for estimating their respective contributions to realized personal income. This approach proved of considerable value in arriving at an understanding of the interrelationships among the various segments of the local economy.

The inter-industry, input-output approach has previously been used in studies of the national economy and of smaller geographic areas such as a group of counties or a metropolitan area. As far as can be determined, however, this study represents the first attempt to utilize this approach in an economic base survey carried out as an integral part of developing a water resource management program for a natural drainage basin. As a result, this report suffers from a lack of precedent, (if this can be considered a limitation), a shortage of applicable data, and from the authors' inexperience in the use of this tool of analysis. Future efforts, however, can benefit from this initial endeavor.

The projections developed in this study are perhaps no more reliable than those that would have been obtained through the use of a more conventional approach. Its only claim to improvement over old methods is in its demonstration that flexibility can be built into economic base studies. This alone is a tremendous step forward because it allows for continual updating and improvement of the projections as new and more detailed data become available. This attribute is a prerequisite for economic base studies carried out in conjunction with long-range water resource management planning--a function which by necessity is a never-ending process.

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A PRELIMINARY ECONOMIC BASE SURVEY OF THE ANIMAS-LAPLATA PILOT PROJECT WATERSHEDS IN THE FOUR CORNERS AREA OF THE COLORADO RIVER BASIN

by

K. C. Nobe and G. G. Collins*

INTRODUCTION

This report presents an initial analysis of the present and probable future economy of the Animas-LaPlata watersheds. These preliminary data are subject to revision. At a later date the study area will be included in an economic evaluation of the San Juan River Subbasin as a part of the comprehensive water quality management study of the Colorado River Basin.

The broad comprehensive body of statistical information used in this economic evaluation of the study area was obtained primarily from official reports of Federal and State agencies, unpublished information from numerous sources, and from limited field investigation. The current development boom in the study area traces its origin to the close of World War II. For this reason, an analysis of the area's development history is confined primarily to the post-war years. Although this area has experienced other periods of rapid economic growth, those occurring prior to 1940 lend little to an understanding of its future development possibilities. Projections of future conditions were developed for 1965, 1980, and 2010.

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* Dr. Nobe and Mr. Collins are, respectively, Senior Project Economist and Economist, Colorado River Basin Water Quality Control Project, U. S. Public Health Service, Region VIII, Denver, Colorado.

Purpose of the Study

The major objective of the Animas-LaPlata Pilot Project, of which this economic base survey is an integral part, is to develop methodology for use in comprehensive water quality management planning for the Colorado River Basin. This pilot project corresponds to a "trial run" in the industrial field engaged in prior to full-scale production of a new line of product.

Several objectives are fulfilled by this summary report. First, it provides data on the present economy and projects its probable future growth path which in turn provide the raw material for the development of a water quality management program to meet the anticipated water needs of the area. Second, it provides an opportunity for testing the applicability of an inter-industry input-output analysis in a base study oriented to water quality management planning. Finally, it contains a storehouse of statistical information that may help to some degree in meeting data needs in development planning at the local level.

A note of caution is in order regarding potential uses of data and conclusions contained in this report. Although the conclusions are based on an analysis of all readily available information, they were developed, nonetheless, without a detailed consideration of the probable effects of national and regional growth on this local area. Its geographic extent is too small to allow for adequate consideration of these external factors. These preliminary findings, therefore, can serve only as a general guide to local development possibilities.

Major Sources of Information

A complete listing of published data sources is found in the bibliography. In addition, however, a number of persons who provided access to preliminary findings of studies now underway, other unpublished data, opinions, and helpful advice, merit further mention.

Considerable assistance in evaluating the future agricultural development possibilities was provided by personnel from the Bureau of Reclamation, U.S. Department of Interior, and the Economic Research Service, U.S. Department of Agriculture. Mr. William F. Crabtree of the Bureau of Reclamation gave freely of his time in discussing the feasibility reports prepared by his office for the Florida and the Animas-LaPlata Projects, as well as providing preliminary findings from studies in the local area which are still in progress. Mr. Carl Smith of the Economic Research Service provided a review of the agricultural data contained in this report and provided access to unpublished data from detailed farm management schedules obtained in the Florida project area.

Data sources dealing with the manufacturing and commercial sectors of the local economy were obtained through the assistance of Professor R.W. DeLaney, of Fort Lewis A. and M. College. He gave permission to utilize a number of unpublished manuscripts dealing with a study of the local economy which were developed by the late Professor W.L. Heuser. These studies were underway under Professor Heuser's supervision while he was the Director of the Bureau of Business and Economic Research at Fort Lewis A. and M. Without access to these unfinished studies, as complete an analysis of the manufacturing and commercial sectors as contained in this report would not have been possible.

The assistance and guidance of Mr. Richard E. Lund, Research Associate in the Division of Business and Economic Research at the University of Wyoming was invaluable in pursuing an inter-industry input-output approach in the methodology used in this effort. At an early date Mr. Lund provided a prepublication copy of his report, A Study of the Resources, People, and Economy of Southwestern Wyoming in which he pioneered the use of this technique in evaluating the economy of small geographic areas. Due to the similarity of the two areas, in terms of present economic activity and resource base, a number of input-output coefficients which he developed were adaptable for use in the Animas-LaPlata effort. During the development of this study he gave freely of his time and provided access to unpublished supporting data for the Wyoming report which were applicable to our area.

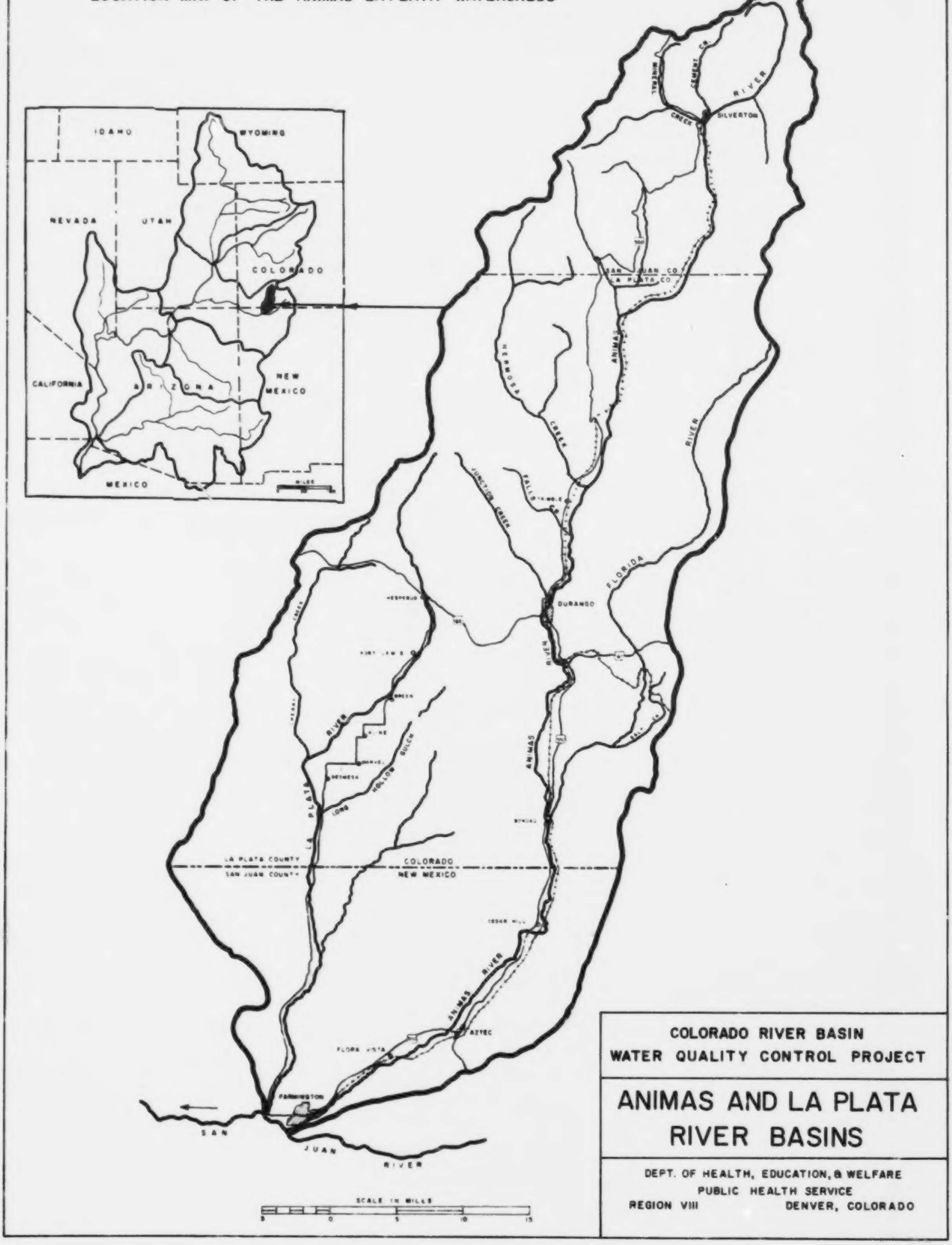
Without the cooperation of various Federal and State agencies, and in particular a number of individuals, the subsequent analysis of the present and future economy of the Animas-LaPlata study area could not have been successfully accomplished. While we are indebted for this assistance, responsibility for the analysis and conclusions, nonetheless, rests solely with the authors.

Description of the Study Area

The Animas and the LaPlata watersheds are two of the major upstream sub-basins of the San Juan drainage system. Combined, they encompass a drainage area of slightly more than 2,000 square miles. They lie in the southwestern corner of Colorado and northwestern corner of New Mexico (Fig. 1). They include most of San Juan and LaPlata Counties, Colorado and a small portion of San Juan County, New Mexico (Table 1).

FIGURE NO. I

LOCATION MAP OF THE ANIMAS-LA PLATA WATERSHEDS


IDAHO
WYOMING
NEVADA
UTAH
COLORADO
CALIFORNIA
ARIZONA
NEW MEXICO
MEXICO
MILES
MINERAL
CEMENT CR.
CREEK
RIVER
SILVERTON
SAN JUAN CO.
LA PLATA CO.
HERMOSA
CREEK
ANIMAS
RIVER
JUNCTION CREEK
FALLS CREEK
DURANGO
FLORIDA
HESPERUS
FORT LEWIS
CREEK
LA PLATA
RIVER
LONG
HOLLOW
GULCH
ANIMAS
RIVER
SALT CR.
LA PLATA COUNTY
SAN JUAN COUNTY
COLORADO
NEW MEXICO
CEDAR HILL
ANIMAS RIVER
AZTEC
FLORA VISTA
FARMINGTON
SAN
JUAN
RIVER
SCALE IN MILES
5
0
5
10
15

COLORADO RIVER BASIN
WATER QUALITY CONTROL PROJECT

ANIMAS AND LA PLATA
RIVER BASINS

DEPT. OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION VIII DENVER, COLORADO

Table 1. Land Area in the Animas-LaPlata Watersheds by Political Sub-Divisions.

State and County	Total Land Area		Measured Portion in Study Area 1/		
	Acres	Sq. Miles	Percent	Acres	Sq. Miles
COLORADO					
La Plata	1,078,400	1,685	72.3	779,800	1,219
San Juan	250,880	392	94.5	237,000	370
Sub-totals	1,329,280	2,077	****	1,016,800	1,589
NEW MEXICO					
San Juan	3,529,600	5,515	7.8	275,300	430
Totals	4,858,880	7,592	****	1,292,100	2,019

1/ Rounded to nearest 100 acres and nearest square mile.

Source: Total land area figures from State and County Area Tabulations for the Colorado River Basin, Basic Data Report No. 1, Colorado River Basin Water Quality Control Project, U. S. Department of Health, Education, and Welfare, Public Health Service, Region VIII, Denver, Colorado, January 1962.

The study area is composed of two major geographic sub-divisions - mountains and high mesa country. The area north of Durango, Colorado is included for the most part in the mountain division with elevations ranging upwards from 8,000 feet. Access is limited primarily to narrow stream valley routes. The area south of Durango consists of arid, high mesa country with elevations ranging from 5,000 to 7,000 feet.

Almost two-thirds of the study area is in public ownership (Table 2). Most of San Juan County, Colorado and that portion of LaPlata County, Colorado lying above Durango, are included in the San Juan National Forest. A fifteen mile wide band along the southern boundary of LaPlata County is included in the Southern Ute Indian Reservation. The remainder of the study area is held primarily in private ownership and it is in this portion of the basin that most of the economic activities are carried on. 1/

The study area is sparsely settled. A high proportion of its population is concentrated in and around Durango, Colorado and Farmington, New Mexico. Both of these cities have experienced a phenonomal rate of growth during the last two decades. Smaller population centers in the area include Aztec, New Mexico and Silverton, Colorado.

Transportation facilities are hampered by rugged terrain. The Denver, Rio Grande, and Western Railroad constructed a narrow-gauge line from Farmington, New Mexico to Silverton, Colorado during the height of the mining boom of the last century and for a number of years it served as the only dependable north-south transportation route. The lower portion of the route, from Farmington to Durango, is still used for hauling freight on a year round basis. The upper portion is used during

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1/ Refers to the Colorado portion of the study area only

Table 2 Land Ownership in the Animas-LaPlata Study Area. 1/

Type of Ownership	San Juan County		La Plata County		Total	Total
	Acres	Percent	Acres	Percent	Acres	Percent
Private	21,918	9.0	436,916	41.5	458,834	35.4
State and Local Government						
State	1,920	.8	8,761	.9	10,681	.8
Local	172	.1	3,420	.3	3,592	.3
Sub-totals	2,092	.9	12,181	1.2	14,273	1.1
Federal Government						
National Forests	185,995	76.4	381,500	36.3	567,495	43.8
Bureau of Land Management	33,241	13.7	27,077	2.6	60,318	4.7
Military Reservations	--	--	--	--	--	--
Indian Lands	--	--	193,951	18.4	193,951	15.0
Sub-totals	219,236	90.1	602,528	57.3	821,764	63.5
Total Land Area						
Actual	250,880		1,078,400		1,329,280	
Computed	243,246	100.0	1,051,625	100.0	1,294,871	100.0
Difference 2/	- 7,634		- 26,775		- 34,409	

Source: Colorado Yearbook, 1959-1961, Colorado State Planning Division, Denver, Colorado

1/ The Animas-LaPlata watersheds study area as evaluated in this report is represented by data for LaPlata and San Juan Counties, Colorado. Data for San Juan County, New Mexico, 7.8 percent of which lies in the drainage area, is not included.

2/ Difference in actual and computed data due to the fact that the Federal lands figures include the private land figures which are held in scattered holdings throughout the Federal land area.

the summer months as a major tourist attraction. A spur of the narrow gauge from Durango to Alamosa, Colorado is still in use.

The major north-south highway is U.S. 550 which connects with Farmington to the south and major cross-country transportation routes at Montrose, Colorado to the north. U.S. highway 160 traverses the area from east to west. This route is expected to carry a tremendous increase in traffic upon completion of the Navajo Trail through the Four Corners Area. Plans are already under consideration for widening the route to four lanes over Wolf Creek Pass east of Durango. Airport facilities are located at Durango and Farmington. In recent years they have been carrying an increasing proportion of the tourist and freight traffic of the area.

Methodology

An overall economic base survey is a prerequisite to the preparation of a series of alternative water quality management plans for the Colorado River Basin. Such an effort is concerned with much more than "pure" economics. It must identify and measure, insofar as practicable, the demographic, social, legal, institutional, political, geographical and technological factors relevant to present and expected future economic activities in the Basin. Economic projections prepared as a part of such planning activities must be more specific, yet more flexible, than standard types of economic base studies, particularly in regard to the identification and location of future major water using industries.

The economic base survey of the Animas-LaPlata study area was undertaken in order to develop suitable methodology for carrying out an overall economic base survey of the Colorado River Basin.

The intention of this endeavor was to develop a procedure by which a flexible economic model of the study area could be devised for evaluating the effects of possible alternative growth paths on the area's water quality. With the use of such a model, rapid data processing machines can be employed to manipulate the data in response to expected future changes in the rate and concentration of economic activity.

The survey was initiated with a field reconnaissance of the study area in order to obtain first-hand observations of current economic activity. While in the area, considerable quantities of published and unpublished statistical data were also obtained and a number of local people engaged in economic development activities were interviewed. This information was supplemented at a later date by data provided by various Federal and State agencies, and universities.

Evaluations of the assembled data and preparation of economic projections to the year 2010 were carried out in four distinct steps. These are discussed below:

1. An Analysis of Major Indicators of Recent Economic Development

This step was carried out to give an initial insight into the current economic development level of the area. For this purpose, five indicators were evaluated: 1) Population trends; 2) Industrial activity; 3) Gross sales; 4) Retail sales tax collections; and 5) Bank deposits. Changes in these indicators in recent years were compared to changes observable in two adjacent areas in order to provide some perspective to those observed in the study area.

2. An Evaluation of Resource Utilization

This phase of the study was carried out in order to determine the manner in which the current economy of the area developed and to evaluate its capacity for future growth. This analysis assumed considerable importance in this survey because in a relative sense, a stable long-run development of the area is just getting underway. How rapidly this development progresses, will depend to a large degree upon the supply of basic resources in the area and upon how effectively its population recognizes their development possibilities.

Major consideration was given to the following components affecting resource utilization in the area: 1) Population and labor force; 2) Agriculture; 3) Recreation; 4) Mineral development; and 5) Manufacturing activity. These were selected because they represent the major activities in an economy which are responsible for heavy water use and pollution loadings. Although water resource development planning is concerned primarily with these basic activities, one must still develop a forecast of the overall economy in order to assess the impacts of these major activities on the secondary activities under varying conditions in the future. Additional consideration was given, therefore, to an analysis of the commercial sectors of the economy including retail trade, wholesale trade, services, transportation, utilities, rentals, finance, construction and to the various economic activities of Federal, State and local government.

3. Interrelationship Within the 1960 Economy

A flexible model of the study area economy was subsequently employed in order to evaluate the interactions of these various sectors. An interindustry input-output approach developed by Mr. Richard Lund in a recent study of southwestern Wyoming was employed for this purpose. 1/ The input-output model developed for the study area's present economy included the

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1/ R.E. Lund, A Study of the Resources, People, and Economy of southwestern Wyoming, College of Commerce and Industry, University of Wyoming, Laramie, Wyoming (Draft for Criticism and Review) January 1962.

following 16 categories: 1) Agriculture; 2) Minerals-oil and gas; 3) Minerals-all other; 4) Manufacturing; 5) Transportation; 6) Utilities; 7) Wholesale trade-general; 8) Wholesale trade-farm; 9) Retail trade; 10) Services; 11) Rentals and finance; 12) Contractors; 13) Local government; 14) Household consumption; 15) State and Federal Government revenue; and 16) the Import-Export components.

Ideally, further breakdowns in several of the above categories would have been carried out but limitations of time and data in this initial effort did not permit it. These would include, for example, a subdivision of agriculture into irrigated and non-irrigated farms; a further breakdown of manufacturing in order to identify the major water using industries such as pulp and paper, chemicals, petroleum and coal products; food processing, and wood products; a breakdown of the retail trade categories. Such subdivisions of data are anticipated in the overall economic base survey of the Colorado River Basin.

Following construction of the basic model, an analysis was made of the major sources of basic income and their effect on the other sectors of the local economy. This step served a useful purpose in that it clearly indicated that not all industries have the same kind of multiplier effect on the local economy. In some cases, an industry with an extremely small export volume (in dollars) had a greater local impact than a larger volume industry.

4. A Projection of the Probable Economic Growth Path

This phase of the study was devoted to the development of economic projections to the year 2010. The flexible economic model was used in this effort. Initially, independent population and labor force projections were developed, consistent with national forecasts prepared by the National Planning Association. 1/ Subsequently, an analysis of available forecasts for the major basic industries was carried out in order to ascertain the expected increases in efficiency for each sector. 2/ The coefficients developed for the 1960 base year were subsequently modified and a preliminary projection of the economy was carried out. Next, a comparison was made of expected resource utilization with the existing resource base and subsequent revisions were made where appropriate.

Water quality constraints were not taken into account in this initial analysis for reasons discussed below. After total dollar volumes for each of the sectors of the economy were ascertained, physical units of production for the basic industries were added where possible. With the completion of this last step, the objectives of the base survey were met, but subsequently, manipulation of the various sectors in the projected economy will be carried out in conjunction with the development of alternative water quality management plans.

Use of the Economic Survey Report as a Planning Tool

Following completion of the economic base survey, the engineering personnel of the Comprehensive Planning Unit of the Colorado River Basin Project will translate the physical units of production attributable to the basic producing sectors of the projected economy into pollution

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1/ Outdoor Recreation Resources Review Commission, Projections to the Years 1976 and 2000, Study Report No. 23, "Industry Output, Employment, and Productivity in the Years 1976 and 2000", prepared for ORRRC by the National Planning Commission, Washington, D. C., 1962.

2/ See for example: A 50-Year Look Ahead at U.S. Agriculture, U. S. Department of Agriculture, Washington, D. C., June 1959.

loadings under assumed treatment conditions. These will be routed downstream from their sources. The cumulative effects on downstream uses will then be determined in relation to desired water quality objectives.

The nature of the next step in water quality management planning will be dependent upon whether or not the combined impact of the projected economy will impair water quality beyond given water quality objectives. To illustrate, let us assume that the projected economy of the study area will not aversely affect the water quality with the exception of excess chlorides attributable to projected irrigation expansion. Let us say their concentration exceeds the desired level by 20 percent. With the use of the flexible economic model, the projection of the agricultural sector will be modified in such a way that its excess pollution contribution falls within acceptable limits and the remaining sectors adjusted so that the overall economy is again in balance. Perhaps even further modifications would be needed, if due to this modification, some other sector exceeds the limits set for the particular type of pollutants it produces. It will be desirable to program the basic economic model for rapid data machine manipulation since a number of approximations may be necessary when developing water quality management plans for various sectors of the sub-basin.

A number of alternative water quality management plans, coordinated with alternative economic growth paths of the area, can be developed with the use of the above procedure. By use of the economic model for each situation, the relative merits of each alternative plan can be ascertained by referring to the total economy generated in each case. This will result in a practical application of the "optimum total welfare" concept to planning for water quality management.

The final step in the development of comprehensive programs for water quality management will be the written presentation of a selected limited number of feasible management plans. This report will indicate not only the physical management aspects involved in each alternative plan but specify as well their relative impacts on the health and welfare of the study area. Presentation of the plans in this manner will provide a basis for comparing the advantages of one plan with another.

Economic analysis within this framework provides the basis for indicating both the relative costs of the alternative plans offered for consideration and the relative returns that can reasonably be expected. Unless data on both costs and benefits are provided in this manner, no intelligent choice among alternative plans can be made. The importance of the initial economic base survey in the overall effort should therefore be apparent.

Basic Assumptions

The development of an economic base survey in conjunction with planning for water quality management requires adherence to a specific set of ground rules for taking into account unknown but highly important future economic developments. The projections contained in this report were developed within the assumptions developed for the overall Colorado Basin study effort. These are as follows:

1. The timely availability of water of suitable quality to support the projected economy without being a constraint

to economic growth will be maintained.

2. During the projection time period, the present to 2010, the Nation and the Colorado River Basin will experience a relatively high level of employment, a stable general price level, average weather and a continuation of the current relative needs of the civilian economy and national defense. These needs will be realized by continued development and adoption of technology consistent with a rapidly growing population.

3. National production and product requirements will tend toward an equilibrium under reasonably competitive conditions and the Colorado River Basin will share in the gross national product to the full extent of any competitive advantages for producing specific products and services that it may possess.

4. Probable future social, legal, and institutional changes affecting water use in the Basin area can be estimated without extensive additional study.

Additional note must be taken of special assumptions and data limitations which have a bearing on this study of the Animas-LaPlata watersheds. One peculiarity of economic base surveys, namely, the smaller the study area the more difficult is the preparation of reliable projections, applies with particular impact. The 2,000 square miles contained in the study area represents less than one percent of the land area in the Colorado River Basin. Furthermore, it includes parts of only three counties and the area included from one of them is less than 8 percent of its total area.

Published trend data applicable to the study area was limited to summaries for two counties. As a result, the economy of the lower watersheds, particularly in the immediate Farmington area, was not evaluated in this report. Since pollution effects of the upstream users will have an impact on this downstream economy, this limitation imposes a constraint on the water quality management planning phase. The effects of pollution loadings on downstream users will have to be taken into account by assuming desired water quality objectives, rather than upon a detailed study of the impact of varying water quality on various sectors of the Farmington economy. This is not a permanent handicap since this is an initial study designed primarily for the development of methodology. An analysis of the overall situation will be accomplished at a later date through a subsequent study of the entire San Juan drainage area.

Part I.

AN ANALYSIS OF MAJOR INDICATORS OF RECENT ECONOMIC DEVELOPMENT

The overall effectiveness of an economic base survey depends to a large degree upon the investigators gaining a familiarity with the study area during the initiation of the study. This was accomplished in the Animas-LaPlata survey by means of a field reconnaissance and a preliminary analysis of selected key indicators of recent economic expansion. Data on five such indicators - population, industrial growth, gross sales, retail sales tax collections, and bank deposits - were already available from published reports and from a number of uncompleted studies by the late Professor W.L. Heuser. 1/ Although these available data were for the 1950 - 1957 period, they were utilized without extensive updating in this initial overview of the local economy. Commencing with Part II of the report, however, all data were related to 1960, the selected base year for the projection phase.

Population Growth Trends

All economic development stems from activities undertaken to satisfy human desires. Thus, all resource uses are related to population in some way or other. A basic hypothesis of this study is that through

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1/ A summary view of the area's economy can be found in "The Regional Economy of the Four Corners" by W.L. Heuser, Western Business Review, Vol. 2, No. 3, August 1958, pp. 143-148. Published reports utilized were the following prepared by Professor Heuser for the Bureau of Business and Economic Research, Fort Lewis A. and M. College, Durango, Colorado: The San Juan Basin: Past, Present and Future; An Analysis of the Feasibility of Enlarging the Downtown Shopping Facilities, Durango, Colorado, 1959; and, An Analysis of the Economic Potential of the Cortez, Colorado Area, 1959.

time, changes in the rate of natural resource utilization and corresponding economic development of an area are closely related to the growth, distribution and income characteristics of its population. For this reason, the population growth trend was selected as one of the major indicators of the relative growth of the study area. Local area trends are compared with those of two selected control areas and the State of Colorado in order to gain a perspective.

What has been happening to population growth rates during the last half century and, in particular, during the last decade? These data are shown in Table 3. The study area's population expanded during the 1900 to 1950 period at about the same rate as that of the Gunnison area. It was much slower, however, than that experienced in the San Luis area during this period and only at about half the rate observed for Colorado. During the last decade, however, considerable reorientation of relative growth rates occurred. The rate in the study area greatly exceeded the rate for the Gunnison area and even began to approach the rapidly growing state rate. Within the San Luis area, a net 15 percent decline in population resulted.

These data served as the basis for a tentative conclusion that, at least in a relative sense, a significant increase in economic activity has taken place in the study area during the last decade. Perhaps it could even support a preliminary conclusion that a continuation of this growth rate is likely. A note of caution is needed, however, regarding the validity of such an assumption if based solely on this short term population growth trend. Overestimation is likely, as evidenced by some projections prepared for 1957 by the Colorado State Planning

Table 3. Population Trends in the Animas-LaPlata, San Luis Valley, Gunnison Valley, and the State of Colorado, 1900 to 1960. 1/

Area and Counties	Year			Percent Change	
	1900	1950	1960	1900-1950	1950-1960
Study Area					
LaPlata	7,016	14,854	19,225		
San Juan	2,342	1,459	849		
Total	9,358	16,313	20,074	+ 74	+ 23
San Luis Valley					
Alamosa	4,800	10,525	10,000		
Conejos	5,400	10,116	8,428		
Costilla	3,200	6,047	4,219		
Rio Grande	4,080	12,639	11,160		
Saguache	3,853	5,672	4,473		
Total	21,333	44,999	38,280	+ 111	- 15
Gunnison Valley					
Delta	5,487	17,335	15,602		
Gunnison	5,331	5,689	5,477		
Montrose	4,535	15,024	18,286		
Pitkin	7,020	1,629	2,381		
Total	22,373	39,677	41,728	+ 77	+ 05
State of Colorado	539,700	1,325,089	1,753,947	+ 146	+ 32

Source: Data for 1900 and 1950 obtained from Colorado Yearbook, 1953, Colorado State Planning Division, Denver, Colorado. The 1960 figures are from U.S. Department of Commerce, Bureau of Census, Census of Population: 1960, General Social and Economic Characteristics, Colorado, Final Report, PC(1) 7C, U.S. Government Printing Office, Washington, DC 1961.

1/ The Animas-LaPlata watersheds study area is represented by data from LaPlata and San Juan Counties, Colorado. Data for San Juan County, New Mexico not included.

Commission for the list of counties included in Table 3. 1/ Their estimates for 1957 exceeded the 1960 Bureau of Census count in each case except for Montrose and Pitkin Counties in the Gunnison area.

A closer look at the characteristics of the population and of the utilization of the area's resource base are necessary before conclusions regarding the future growth possibilities of the area can be confirmed. These are discussed in detail in Part II of this report. Before leaving this initial analysis of the area's population, however, let us examine one other aspect of the recent population growth trend. A summary of population expansion and distribution by socio-economic orientation, as shown in Table 4, is used for this purpose. This table provides data on the relative proportion of the total population residing in cities, towns and the open country during the last two decades.

Throughout the 1940 to 1960 period, there has been a definite trend toward urbanization in the study area and in the State of Colorado as a whole. The proportion of the population living in small towns and in the open country have both been declining, with the greatest decline occuring in the small town group. Let us examine these changes more closely, segment by segment.

Urban population in the study area increased from approximately a third of the total population in 1940, to about half by 1950 and to 55 percent by 1960. During this same period, urban population in the state rose from about 50 percent in 1940 to almost two-thirds in 1950 and subsequently

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1/ W.L. Heuser, An Analysis of the Feasibility of Enlarging Downtown Shopping Facilities, Durango, Colorado, op. cit. p.4

Table 4. Population Trends by Socio-Economic Orientation, Animas-LaPlata Study Area, 1940-1960

Area and State	Total Population	Urban		Small Town 1/		Other Rural 2/		Percent Change Total Pop.	
		Total Pop.	% Total Pop.	Total Pop.	% Total Pop.	Total Pop.	% Total Pop.	1940-1950	1950-1960
				1 9 4 0					
Study Area									
La Plata	15,494	5,887	38.0	927	6.0	8,680	56.0		
San Juan	1,439	-	-	1,134	78.8	305	21.2		
Total	16,933	5,887	34.8	2,061	12.2	8,985	53.0		
Colorado	1,035,791	544,826	52.6	125,331	12.1	365,634	35.3		
				1 9 5 0					
Study Area									
La Plata	14,880	7,459	50.1	861	5.8	6,560	44.1	- 4.0	
San Juan	1,471	-	-	1,388	94.4	83	5.6	+ 2.2	
Total	16,351	7,459	45.6	2,249	13.8	6,643	40.6	- 3.4	
Colorado	1,325,089	831,318	62.7	132,509	10.0	361,262	27.3	+ 27.9	
				1 9 6 0					
Study Area									
La Plata	19,225	10,530	54.8	931	4.8	7,764	40.4		+29.2
San Juan	849	-	-	822	96.8	27	3.2		-42.3
Total	20,074	10,530	52.5	1,753	8.7	7,791	38.8		+22.8
Colorado	1,753,947	1,292,790	73.3	65,896	3.8	395,261	22.5		+32.4

Source: U.S. Dept. of Commerce, Bureau of Census, Census of Population: 1960, General Social and Economic Characteristics, Colorado, Final Report PCG27C, U.S. Government Printing Office, Wash., D.C. 1961

1/ All incorporated and unincorporated places of less than 2,500 population.
2/ Includes farm and rural nonfarm population residing in the open country.

to almost three-fourths by 1960. The increase of the urban population segment in the study area concentrated in Durango.

The study area's small town population segment is distributed among three towns - Bayfield and Ignacio in LaPlata County and Silverton in San Juan County. 1/ A major portion of this population segment resided in Silverton. This population group has declined rapidly relative to urban in the study area during the last two decades but not nearly so rapidly as it did in Colorado as a whole. For the state as a whole, this decline is accounted for to some extent by small towns growing large enough to be considered urban, whereas in the study area, the small towns declined relatively in population. The population of Silverton, for example, declined from 1,127 in 1940 to 822 in 1960. It should be noted that the LaPlata County towns actually increased in size in absolute numbers but failed to hold their relative position because of the rapidly expanding urban component.

The open country population segment, represented by "Other Rural" in Table 4, has been declining at about the same rate in both the study area and in the state as a whole. Within the study area it dropped from 53.0 percent in 1940 to 40.6 in 1950 and to 38.8 in 1960. While showing a relative decline from 1950 to 1960 this segment nonetheless increased in terms of absolute numbers--from 6,643 to 7,791. This is accounted for in part by an increase in non-farm population in the open-country areas adjacent to Durango.

What do these trends suggest in regard to economic adjustments probably occuring in the study area? First of all, there is a definite

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1/ Both Bayfield and Ignacio are located outside of the drainage area but since whole county data are used, they show up in the population summary.

trend toward concentration of the area's population in the Durango area, either within the urban complex itself or in the adjacent open-country areas. Secondly, there has probably been a corresponding trend to a higher proportion of the population employed in services, trades, manufacturing, and other urban economic activity. This suggests indirectly that the relative proportion of the population employed in agricultural activity has been declining. There is a clue as well, that mining activity in the Silverton area is a declining segment of the economy as evidenced by the rapid drop in Silverton's population. An analysis of employment and industrial trends are needed, however, to see if these initial conclusions are valid.

Trends in Manufacturing and Agricultural Activity

Table 5 provides comparative data on selected manufacturing and agricultural activity indicators in the study area for 1954 and 1959. The initial analysis is limited to the number of production units and estimated total employment--the following section dealing with utilization of the resource base will provide a more thorough evaluation. Data in Table 5 were limited to manufacturing and agriculture because these two activities are high basic income generators in any economy - as will be shown later, total dollar volumes from minerals, principally oil and gas, exceed both agriculture and manufacturing in the study area but due to its external orientation it has considerablly less impact on local income generation.

The data in Table 5 provide evidence that several significant changes in the economic makeup of the study area are in progress.

Table 5. Number of Operating Units and Estimated Total Work Force in Manufacturing and Agricultural Industries, Animas-LaPlata Study Area, 1954 and 1959.

Type of Activity	1954		1959		Percent Change 1954 to 1959	
MANUFACTURING	Number of Units	Est. Work Force	Number of Units	Est. Work Force	Number of Units	Est. Work Force
Food Processing	10	100	8	110	- 20.0	+ 60.0
Lumber-Wood Prod.	12	130	11	80	- 8.3	- 47.6
Printing-Publishing	2	40	6	80	+ 200.0	+ 66.7
All Other	3	30	6	80	+ 100.0	+233.3
Totals	27	300	31	350	+ 14.8	+ 16.7
AGRICULTURE						
All Farms	833	1,550	677	1,027	- 18.7	- 33.7
Commercial Farms	566	NA	476	NA	- 15.9	--
Farms under 10 acres	57	NA	22	NA	- 61.4	--
Farms 10 to 1000 A	693	NA	556	NA	- 19.8	--
Farms over 1000 A	83	NA	99	NA	+ 19.3	--
Farm Operators		763	--	582	--	- 23.7
Unpaid Family Labor	--	487	--	291	--	- 40.2
Hired Labor	--	300	--	154	--	- 48.7
Total Farm Labor	--	1,550	--	1,027	--	- 32.7

Source: Data obtained from selected sources including: 1954 Census of Manufacturing and 1959 Census of Agriculture, Bureau of the Census, U.S. Dept. of Commerce and from the 1960 Directory of Colorado Manufacturers, Bureau of Business Research, University of Colorado.

Note, first of all, that the total number of units and number of employees in manufacturing activity increased approximately 15 percent and 17 percent respectively from 1954 to 1959. During this same period the number of farms decreased about 19 percent and the farm labor force decreased by about 34 percent. Furthermore, significant changes in the internal makeup of these two major industrial groups occurred.

Manufacturing activity in the study area has only expanded to a moderate degree during this period. The food processing and the lumber-wood products category actually show a decline in the number of operating units and in the later case a major decline in the labor force employed. The increases overall are accounted for primarily by the miscellaneous industries included in the all other category.

Great changes took place in the agricultural industry. Major reductions are evident in each of the data categories listed with the exception of farms of over 1000 acres. These data indicate that, in terms of employment, farming is less important to the local economy than it was several years ago. Although these data give no hint as to the total value of agricultural products produced and how this has changed in recent years, they nonetheless, indicate that the number of people dependent directly upon agriculture as a source of livelihood has declined almost 50 percent in the last five years. It seems reasonable to assume that a major portion of the increased labor force now employed in expanding sectors of the economy have been drawn from this displaced farm population.

Thus far, some physical indicators of recent economic activity have been examined. These have pointed not only to overall economic growth in a relative sense but to significant shifts in the nature of activity as well. The following discussion of a number of financial parameters will provide some further indication of the relative magnitude of the study area's economic growth.

Gross Sales

Changes in gross sales in the study area are compared to changes in the San Luis Valley and the Gunnison Valley for the 1950-1956 period (Table 6). During the period of analysis, the level of sales in the San Luis Valley area remained essentially unchanged while they increased by a fourth in the Gunnison Valley and by over 50 percent in the study area. Note that the two county combined gross sales in the study area were equal to total gross sales in the five county area that makes up the San Luis Valley. On a relative basis, therefore, it is apparent that a period of economic development occurred in the study area from 1950 to 1956 and if more recent comparative data were evaluated, it would probably verify that this trend is continuing. 1/

Retail Sales Tax Collections

Available data in regard to retail sales tax collections, limited to the 1950-1957 period, tend to substantiate the relative growth rates indicated by the gross sales data (Table 7). Total collections increased by 76.9 percent in the study area from 1950 to 1957 compared to an increase of 44.5 percent in the Gunnison area and a decline of 3.4 percent in the San Luis area.

1/ Data on this type regarding absolute growth of the study area are provided in Part II of this report.

Table 6. Gross Sales in the Animas-LaPlata Study Area, San Luis Valley, and the Gunnison Valley, 1950 - 1956. 1/

Area and Counties	1950	1953	1956	Percent Change 1950 - 1956
Study Area				
La Plata	28,825,000	36,555,000	44,807,000	
San Juan	1,211,000	956,000	1,124,000	
Totals	30,036,000	37,511,000	45,931,000	+ 52.9
San Luis Valley				
Alamosa	17,844,000	18,329,000	16,770,000	
Conejos	5,282,000	5,521,000	5,444,000	
Constilla	1,642,000	1,985,000	1,881,000	
Rio Grande	16,962,000	17,840,000	17,237,000	
Saguache	4,103,000	4,693,000	4,297,000	
Totals	45,833,000	48,368,000	45,629,000	- 00.4
Gunnison Valley				
Delta	19,826,000	21,464,000	26,185,000	
Gunnison	8,254,000	8,160,000	9,711,000	
Montrose	18,987,000	21,333,000	21,715,000	
Pitkin	2,229,000	2,918,000	3,102,000	
Totals	49,296,000	53,875,000	60,713,000	+ 23.2

Source: Basic Data taken from: Colorado Precipitation Map, Climatological Data, Population, and Economic Data, Colorado State Planning Division, Denver, Colorado, 1957.

1/ The Animas-LaPlata study area data is limited to data applicable to LaPlata and San Juan Counties, Colorado.

Table 7. Retail Sales Tax Collections in the Animas-LaPlata Study Area, San Luis Valley, and the Gunnison Valley, 1950 - 1957.

Area and Counties	1950	1954	1957	Percent Change 1950 - 1957
Study Area				
La Plata	192,347	262,121	352,131	
San Juan	13,707	9,383	12,399	
Totals	206,054	271,504	364,530	+ 76.9
San Luis Valley				
Alamosa	152,776	150,568	148,950	
Conejos	65,361	59,677	61,074	
Constilla	22,999	24,585	23,448	
Rio Grande	154,189	146,699	147,917	
Saguache	47,311	48,062	46,167	
Totals	442,636	429,591	427,556	- 3.4
Gunnison Valley				
Delta	188,722	186,433	239,530	
Gunnison	70,229	76,344	89,705	
Montrose	160,765	203,940	268,324	
Pitkin	24,651	34,866	44,477	
Totals	444,367	501,583	642,036	+ 44.5

Source: Planning Division, Colorado Yearbooks, 1951 - 1958, Denver, Colorado.

Bank Deposits

Bank deposit data serves as another positive indicator of recent economic growth in the study area relative to two other control areas in the State. Table 8 shows relative data for these three areas for the 1953 - 1957 period and additional 1959 data for the study area. These data suggest that from the standpoint of capital availability for investment purposes, the climate for economic development in the study area has been constantly improving. Bank deposits increased about 31 percent from January 1, 1953 to January 1, 1957 and increased an additional 5.4 percent from January 1, 1957 to January 1, 1959. This amounts to an overall increase of about 38 percent during the total six year period. In contrast, bank deposits in the two control areas have remained more or less static.

The rate of bank deposit increase in the study area has risen at an even faster rate than the rate for the State of Colorado as a whole. During the period 1954 to 1957, the state rate rose 14 percent while the rate for the study area rose 22 percent. 1/

Summary For Part I

An analysis of past trend data for five economic growth indicators - population trends, manufacturing and agricultural activity, gross sales, retail sales tax collections, and bank deposits, indicate both a rapid relative and absolute economic growth in the study area.

1/ Colorado State Planning Division, 1957 Report on Colorado's Bank Resources, Denver, Colorado, July 1957, p.20.

Table 8 Bank Deposits in the Animas-LaPlata Study Area, San Luis Valley, and the Gunnison Valley, 1953-1959.

Area and County	January 1 1953	January 1 1954	January 1 1957	January 1 1959	Percent Change 1953 - 1957
Study Area					
La Plata	13,228,606	14,164,889	17,320,927	18,250,044	
San Juan	1/	1/	1/	1/	
Totals	13,228,606	14,164,889	17,320,927	18,250,044	+30.9
San Luis					
Alamosa	8,802,784	8,148,688	8,865,053	NA	
Conejos	2,423,741	2,209,226	2,214,377	NA	
Costilla	1/	1/	1/	1/	
Rio Grande	4,213,127	3,872,528	3,924,571	NA	
Saguache	3,276,971	2,776,866	2,932,365	NA	
Totals	18,716,443	17,007,308	17,936,366	NA	-04.2
Gunnison					
Delta	8,617,072	8,443,141	10,543,936	NA	
Gunnison	3,774,117	3,775,336	3,761,638	NA	
Montrose	8,021,405	8,270,085	8,863,503	NA	
Pitkin	863,427	942,583	1,422,442	NA	
Totals	21,276,021	21,431,145	24,591,519	NA	+15.6

1/ No banks in these Counties.

Source: Colorado State Planning Division, Colorado Yearbooks 1951-1958, and W. L. Heuser, "The Regional Economy of the Four Corners," Western Business Review, Vol. 2, No. 3, August 1958.

The study area was compared with the San Luis Valley and the Gunnison Valley, as well as with the State of Colorado as a whole. These comparisons show that the study area has had a faster rate of development than that occurring in both of the control areas and, in most cases, than the state as a whole.

It appears reasonable to assume that if the area has a resource base capable of sustaining future growth, continuing increases in its population and associated economic development are likely to occur. Part II, therefore, provides an analysis of its present resource utilization in order to provide for judgements in this regard. It contains information upon which projections of the local area economy were developed and provided the major basis for forecasting which sectors of the economy are most likely to account for the major share of anticipated growth.

Part II

AN EVALUATION OF RESOURCE UTILIZATION IN THE LOCAL ECONOMY

The resource base of any geographic area contains a number of diverse components. An evaluation of resource utilization can proceed in several ways depending upon the objectives to be served. The method used in this survey puts major emphasis on activities in the economy which have significant impacts on the area's water quantity and quality requirements. The net effects of different combinations of these basic industries and secondary activities in an overall economy are needed so that the relative merits of a number of water quality management plans can be ascertained. In order to establish a basis for such an evaluation, an analysis of the present economy (in this case 1960), the inter-relationships of the various sectors of the economy and the possibilities of future growth for each as affected by resource limitations is required. A forecast of the probable economic growth path to the year 2010 is developed in Part IV of the report.

This section of the report, however, is limited to an analysis of how the total economic activity of the study area is produced by the income from basic industries working its way through the secondary sectors of the economy. Part II, therefore, is subdivided into three sections: 1) An analysis of the population and labor force; 2) A discussion of major resource oriented activities having a direct impact on water quality and quantity; 3) A brief summation of the commercial and government revenue producing sectors of the economy. Part III contains a summary of the present situation in the form of an inter-industry input output table.

Population and Labor Force

A discussion of population and labor force in a section dealing with the utilization of an area's resources may seem inconsistent to some. Such an opinion stems of course, from the usual practice of limiting such discussions to those physical components which are commonly termed "natural" resources. A discussion of the area's demographic characteristics is included because an unerstanding of the human attributes and limitations of an area are just as essential to projecting its future growth path as an analysis of its physical resources.

The physical or natural resources of an area are inert in nature unless brought into productive use by human energy and ingenuity; and analysis of the local economy based solely on these components would be sterile. It is within this context that an area's population is considered one of its basic resources.

Two major groups of demographic characteristics are evaluated: 1) General characteristics of a sociological nature including race, age, education, marital status, and housing and migration; and 2) Economic characteristics including employment status, labor force distribution by major industrial categories, family income, and payroll data. The evaluation of these characteristics is limited to the 1940 - 1960 period. 1/

Approximately 20,000 people, or about one percent of the total Colorado population, lived in the study area in 1960. LaPlata County accounted for 95.6 percent of the total and therefore most of the economic activity in the study area is concentrated there. Overall, population in the study area increased by 22.8 percent from 1950 to 1960 but during the previous decade, it decreased by 3.4 percent.

All but 27 of the people in San Juan County live in Silverton which had a 40.2 percent decrease in population from 1950 to 1960. On the other hand, LaPlata County's population, concentrated primarily in Durango, increased by 29.2 percent during this period. Overall population increases in the study area during the last decade have followed the same trend as for the State of Colorado which had an increase of 32.4 percent. During the previous decade, however, the state population increased by 18 percent while the study area's population decreased slightly.

Sociological Characteristics

Four major sociological characteristics are evaluated: racial composition, age distribution, education levels, and the marital-household status (Table 9). These are included to provide an insight into the sociological makeup of the area's population and how it affects the development of skills and managerial ability which will be utilized in the expansion of various sectors of the local economy.

1/ Data obtained from: U.S. Department of Commerce, Bureau of Census, Census of Population, Report for 1940, 1950 and 1960, U.S. Government Printing Office, Washington, D.C.

Table 9 Sociological Characteristics of the Population In the Animas-La Plata Study Area, 1940 to 1960.

Item	1940 Total	1940 % of Total	1950 Total	1950 % of Total	1960 Total	1960 % of Total	% 40-50	% 50-60
Race								
White	16475	97.3	15863	97.0	19361	96.5	- 3.7	+ 22.1
Indian	402	2.4	436	2.7	651	3.2	+ 8.5	+ 49.3
Other	56	.3	52	.3	62	.3	- 7.1	+ 19.2
Total	16933	100.0	16351	100.0	20074	100.0	- 3.4	+ 22.8
Age Distribution								
Under 5 years	1860	11.0	1939	11.9	2517	12.5	+ 4.2	+ 29.8
5-19	4825	28.5	4507	27.6	6221	31.0	- 6.6	+ 38.0
20-65	9148	54.0	8577	52.4	9721	48.4	- 6.2	+ 13.3
Over 65	1100	6.5	1328	8.1	1615	8.1	+ 20.7	+ 21.6
All Ages	16933	100.0	16351	100.0	20074	100.0	- 3.4	+ 22.8
Education								
(25 yrs. & older)	8825	100.0	8560	100.0	10304	100.0	- 3.0	+ 20.4
No school yrs compl.	322	3.7	165	1.9	151	1.5	- 48.8	- 8.5
1-7 yrs elem.school	1558	17.7	1315	15.4	972	9.4	- 15.6	- 26.1
8 yrs. elem.school	2834	32.1	2200	25.7	1902	18.5	- 22.4	- 13.5
1-3 yrs high school	1546	17.5	1465	17.1	1881	18.3	- 5.2	+ 28.4
Compl. high school	1485	16.8	1830	21.4	2911	28.2	+ 23.2	+ 59.1
1-3 yrs college	642	7.3	865	10.1	1505	14.6	+ 34.7	+ 74.0
College 4 yrs or +	382	4.3	580	6.8	982	9.5	+ 51.8	+ 69.3
Sch.yrs.not reported	56	.6	140	1.6	--	--	+ 150.0	--
Median yrs. compl.	8.8		10.1		12.1		+ 14.8	+ 19.8
Marital Status								
Household								
Married couples	NA	--	3560	100.0	4515	100.0	--	+ 26.8
w/sep.households	NA	--	3380	94.9	4472	99.0	--	+ 32.3
w/o sep.households	NA	--	180	5.1	43	1.0	--	- 76.1
Families & Unrelated Indiv.	NA	--	5015	100.0	6275	100.0	--	+ 25.1
No. of families	NA	--	3935	78.5	5015	79.9	--	+ 27.4
No.of unre. ind.	NA	--	1080	21.5	1260	20.1	--	+ 16.7
Households								
Total Number	NA	--	4636		5730		--	+ 23.6
Pop.in households	NA	--	15883		19825		--	+ 24.8
Pop.per household	NA	--	3.43		3.46		--	+ .9
Institutional Pop.								
Total Number	NA	--	18		9	--	--	- 50.0
Location of Res. in prev.yr(1yr&older)								
Within study area	NA	--	13730	87.1	12206	69.5	--	- 11.1
Outside study area	NA	--	1930	12.2	5274	30.1	--	+173.3
Residence not rep.	NA	--	105	.7	77	.4	--	- 26.7
Total	NA	--	15765	100.0	17557	100.0	--	+ 11.4

They provide, in addition, some clues as to the manner in which the sociological climate of the area is being altered by additions to its population through migration. This latter point is of particular significance because in recent years a large percentage of the area's population arrived by the migration route.

Racial Composition

The population is primarily caucasian. In 1960, 19,361 persons, or 96.5 percent, were in this category. On a percentage basis this is a slight decline from the 97.3 percent reported in 1940. The Indian population, currently 713 persons, has increased steadily. In 1940, Indians accounted for 2.7 percent of the total population and by 1960, they accounted for 3.5 percent. Only 62 persons of other races were reported in 1960.

Age Distribution

Changes in the two age groups, 19 years and under, and 20 to 65 years, follow the same trends as overall population changes. The number of persons under 19 years declined by 3.6 percent from 1940 to 1950 and increased by 35.6 percent from 1950 to 1960. Likewise, the number of persons in the 20 - 65 age group declined by 6.2 percent from 1940 to 1950 and increased by 13.3 percent in the last decade. Overall, the changes in age distribution in the study area during the last two decades approximate those observed in the State of Colorado during this same period.

Educational Levels

The educational level of the people in the Animas-LaPlata study area is currently the same as for Colorado and the Mountain States but above the national level. The median years of school completed is 12.1, compared to 12.1 for Colorado, 12.0 for the Mountain States and 10.5 for the United States as a whole. (Table 10) Significant increases in the educational level in the study area were achieved in the last two decades as shown previously in Table 9. Almost four percent of the population 25 years and older had completed no school years in 1940; by 1960 this group had dropped to 1.5 percent. During the same period the percentage that had completed 8 years of school rose from 16.8 to 28.2.

Table 10. Educational Levels of Persons 25 Years and over, in the Animas-La Plata Study Area, Compared with Colorado, the Mountain States, and the United States, 1960.

Years of School Completed	Animas-LaPlata Study Area	Colorado	Mountain States	United States
	(percent)	(percent)	(percent)	(percent)
8th Grade or Less	29.4	30.1	29.3	38.0
High School				
1 - 3 years	18.3	17.9	19.1	18.3
4 years	28.2	28.9	29.3	27.4
College				
1 - 3 years	14.6	12.4	12.9	8.2
4 years or more	9.5	10.7	9.4	8.1
Median Years	12.1	12.1	12.0	10.5

Source: U. S. Census of Population, 1960.

The influence of Fort Lewis A. & M. College in Durango can be detected from the data contained in Table 10. Within the study area, 14.6 percent of the group completed 1-3 years of college compared to 12.4 percent for the State of Colorado. The percentage that have completed four years or more was 9.5 compared to 10.7 for Colorado. Fort Lewis A. & M. College is a junior college, easily accessible to people in the study area, whereas four year colleges are located at a considerable distance. Since plans are currently underway to upgrade Fort Lewis A. & M. to a four year, degree granting institution, it seems reasonable to conclude that the percentage of the local population attaining a four year college education will increase significantly in the near future.

Marital Status and Household

Statistics on the proportion of the population who are married and number of persons per household remained unchanged during the 1940 - 1960 period. There has been an increase in recent years, however, in the percentage which maintain separate households; it rose from approximately 95 percent in 1950 to 99 percent in 1960. This is reflected to some degree in the increased activity in the local building trade.

Data relative to where the local population lived the year prior to the 1950 and 1960 census counts indicates that the rate of immigration has increased tremendously during this period. In 1950, only 12.2 percent of the population indicated that they had lived outside the study area during the previous year; by 1960, this group accounted for 30.1 percent of the total population. Apparently immigration was completely offset by out-migration, however, during the 1950 - 1960 period. Overall migration estimates developed from data on births and deaths show a net out-migration of 32 persons during this decade. [1] With no migration in or out of the area, the expected population in 1960 could have been 20,106 whereas the actual count was 20,074.

Economic Characteristics

Table 11 contains a number of items pertaining to the economic characteristics of the local population. These include employment status, employment by major industry category, and some information on levels of family income and payrolls. These are discussed in turn below:

Employment Status

The total labor force (men and women 14 years old and over) experienced a decline of 4.5 percent from 1940 to 1950 followed by an increase of almost 15 percent during the 1950 - 1960 period. Local unemployment has been declining during the last two decades. In 1940, 14.9 percent of the total labor force fell in this category, compared to only 5.3 percent in 1950 and 5.1 in 1960. The ratio of total population to labor force has remained relatively constant at about 2.8:1 in recent years.

The total labor force included 7,193 persons in 1960. This involved 1,145 self-employed persons, 4,503 hired workers, 70 unpaid family workers, 1105 government workers and 370 unemployed. The percentage distribution into these categories is almost identical to the distribution for the State of Colorado as a whole (Figure 2). Major

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[1] Unpublished data obtained from Mr. Donald Davids, Colorado State Department of Public Health, Records and Statistics Section, by interview, April 1962.

Table 11 Economic Characteristics of the Population in the Animas-LaPlata Study Area, 1940 to 1960.

Item	1940			1950			1960			%	%
	Total	% of Total		Total	% of Total		Total	% of Total		40-50	50-60
Employment Status											
No. 14 yrs. & over	12060		100.0	11522		100.0	13234		100.0	- 4.5	+ 14.9
Labor Force	6052	100.0	50.2	6057	100.0	52.6	7206	100.0	54.5	+ .1	+ 19.0
Non-civilian	NA	-		10	.1		13	.2		-	+ 30.0
Civilian	6052	100.0		6047	99.9		7193	99.8		- .1	+ 19.0
Employed	5149	85.1		5728	94.7		6823	94.9		+11.2	+ 19.1
Non-employed	903	14.9		319	5.3		370	5.1		-64.7	+ 16.0
Not in Labor Force	6008	100.0	49.8	5465	100.0	47.4	6028	100.0	45.5	- 9.0	+ 10.3
Keeping house	3714	61.8		3378	61.8		NA	--		- 9.0	--
Unable to work	741	12.3		523	9.6		NA	--		-29.4	--
Confined in Inst.	11	.2		18	.3		16	.3		+63.6	- 11.1
Other	1542	25.7		1546	28.3		6012	99.7		+ .3	+288.9
Ratio of Pop. to Total Labor Force	2.80			2.70			2.79			- 3.6	+ 3.3
Ratio of Pop. to Civilian Labor Force	2.80			2.70			2.79			- 3.6	+ 3.3
Major Industry Group											
Agriculture	1399	27.2		1245	21.7		674	9.9		-11.0	- 45.9
Forestry & Fisheries	15	.3		20	.3		84	1.2		+33.3	+320.0
Mining	403	7.8		514	9.0		801	11.7		+27.5	+ 55.8
Construction	383	7.4		457	8.0		501	7.3		+19.3	+ 9.6
Manufacturing	236	4.6		404	7.1		352	5.2		+71.2	- 12.9
Recreational Serv.	46	.9		50	.9		48	.7		+ 8.7	- 4.0
All Others	2667	51.8		3038	53.0		4363	64.0		+13.9	+ 43.6
Total	5149	100.0		5728	100.0		6823	100.0		+11.2	+ 19.1

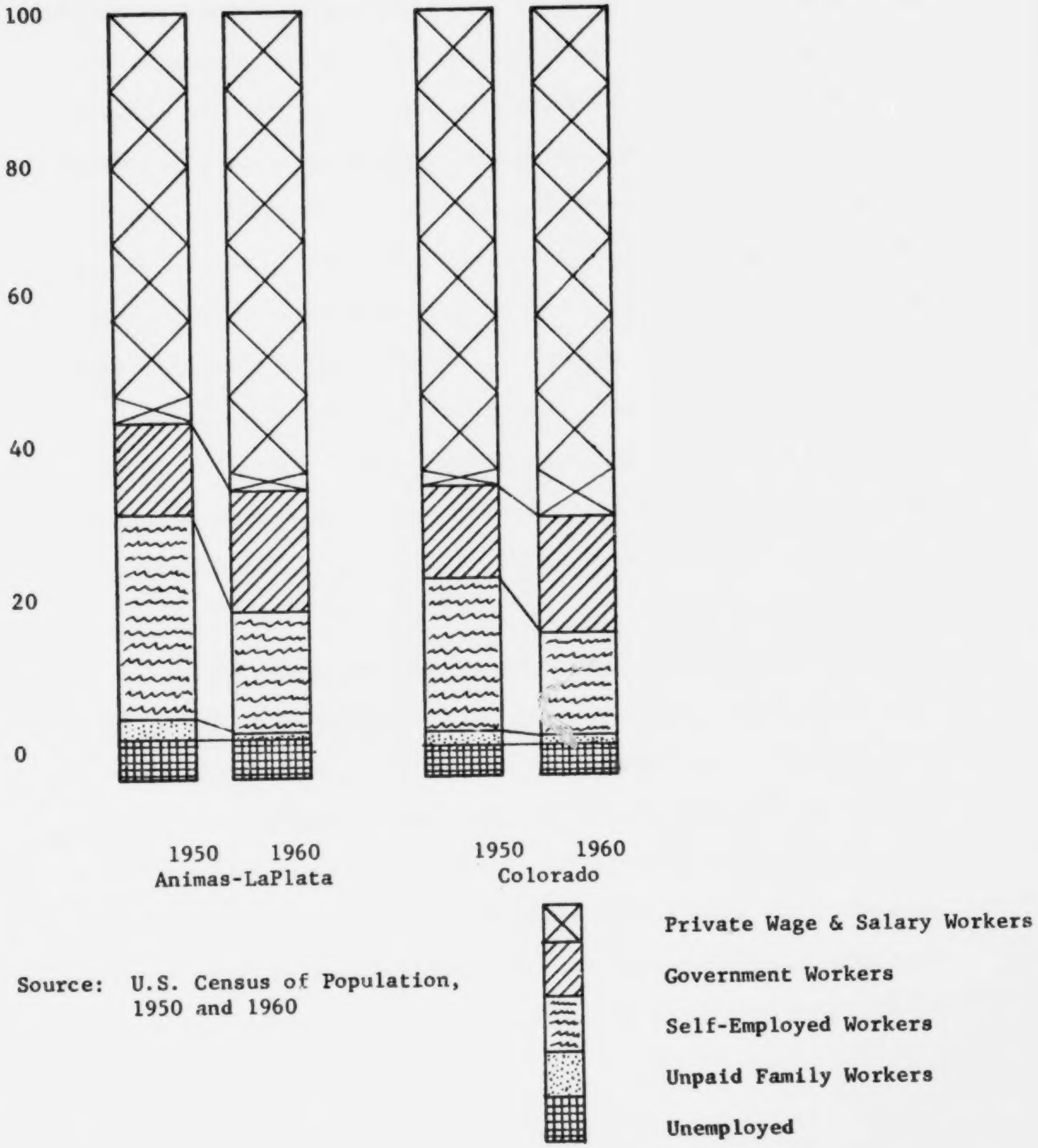
(Continued)

Table 11 (continued)

Item	1940		1950		1960			
	Total	% of Total	Total	% of Total	Total	% of Total	40-50	50-60
Family Income								
All classes	NA	--	3935	100.0	5015	100.0	--	+ 25.1
Less than $1,000	NA	--	675	17.2	278	5.5	--	- 58.8
$1,000 to $1,999	NA	--	860	21.9	435	8.7	--	- 49.4
$2,000 to $2,999	NA	--	840	21.3	517	10.3	--	- 38.5
$3,000 to $3,999	NA	--	655	16.6	514	10.3	--	- 21.5
$4,000 to $4,999	NA	--	365	9.3	616	12.3	--	+ 68.8
$5,000 to $5,999	NA	--	165	4.2	616	12.3	--	+273.3
$6,000 to $6,999	NA	--	75	1.9	510	10.2	--	+580.0
$7,000 to $9,999	NA	--	95	2.4	940	18.7	--	+889.5
$10,000 and over	NA	--	60	1.5	589	11.7	--	+881.7
Income not reported	NA	--	145	3.7	--	--	--	-100.0
Median Income	NA	--	$2446		$5239		--	+114.2

Figure 2

Trends in Labor Force by the
Type of Income, Animas-LaPlata
Study Area and the State of Colorado



Source: U.S. Census of Population, 1950 and 1960 changes in both areas during the last decade involved a substantial decline in self employed persons, and an offsetting increase in private wage and salary workers.

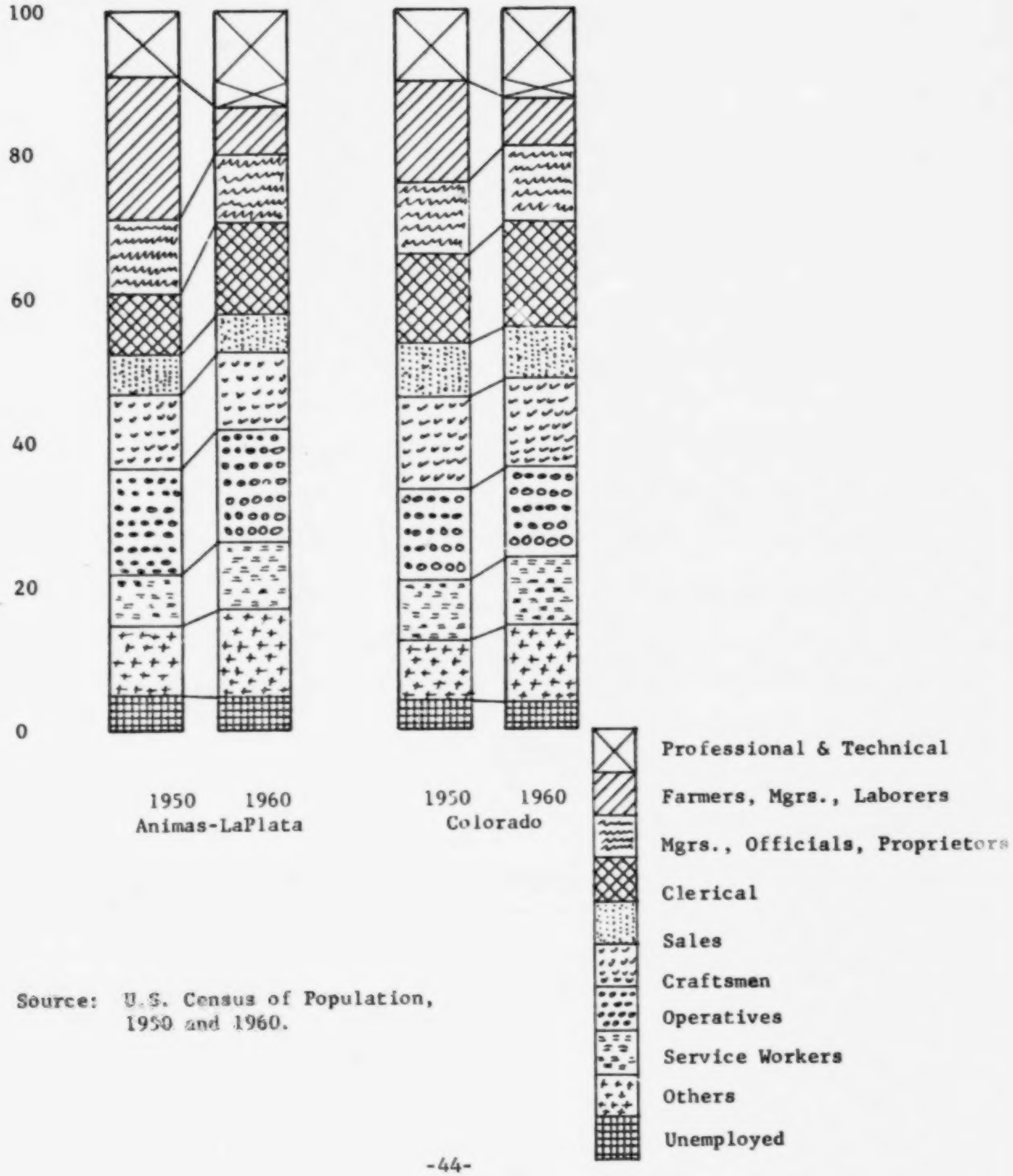
Greater detail on internal shifts in the labor force is revealed by data on occupation. Trends in the study area, compared to the State of Colorado for the 1950 - 1960 period, are shown in Figure 3. The greatest change within the study area occurred in the farm category. It declined from 20.4 percent of the employed labor force in 1950 to 6.8 percent in 1960. During the same period, the Colorado figures indicated a decline from 14.1 percent in 1950 to 7.0 percent in 1960. Most of the decline in farm workers was offset by an increase in professional and technical workers. The proportion in this group rose from 9.0 percent in 1950 to 13.3 percent in 1960. The clerical workers group increased from 7.9 percent to 12.7 percent during the same period. The distribution of persons in different occupation classes in the study area in 1960 compared closely to the distribution for Colorado.

Employment Distribution by Major Industry Categories

Figure 4 indicates the total number of persons, including the self-employed group, employed in each industry in the study area compared to Colorado as a whole. The distributions compare quite closely in the commercial categories but substantial differences are present in the basic income producing sectors. The study area has a much greater proportion of its labor force engaged in agriculture and mining and a much lower percentage in manufacturing than the state as

Figure 3

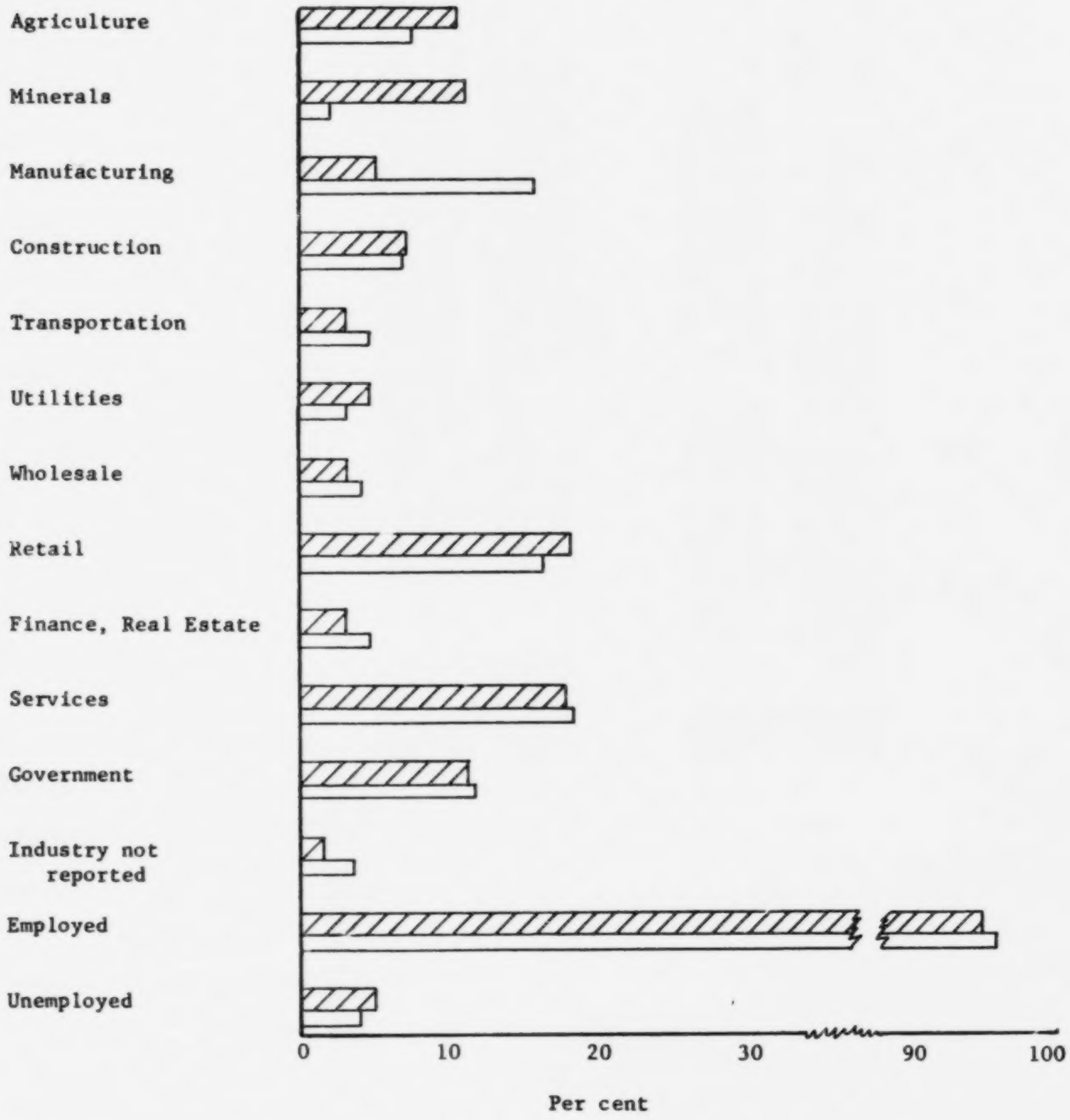
Trends in Labor Force by Occupation Animas-LaPlata Study Area and the State of Colorado, 1950 and 1960.



Source: U.S. Census of Population, 1950 and 1960.

Figure 4

Total Labor Force by Industry Groups
Animas-LaPlata Study Area and the
State of Colorado - 1960



a whole does. Retailing and services employ the largest number of persons, accounting for about 18 percent of the total in each case. Next in terms of number of employees, were agriculture, minerals and government which each employ from 10 to 12 percent of the total. Certain industries such as agriculture, lumbering, and construction have their peak employment during the summer months. The commercial sectors dependent primarily upon the tourist trade likewise show a summer high. Nevertheless, seasonality of employment in the study area is not as pronounced as in some other areas in Colorado.

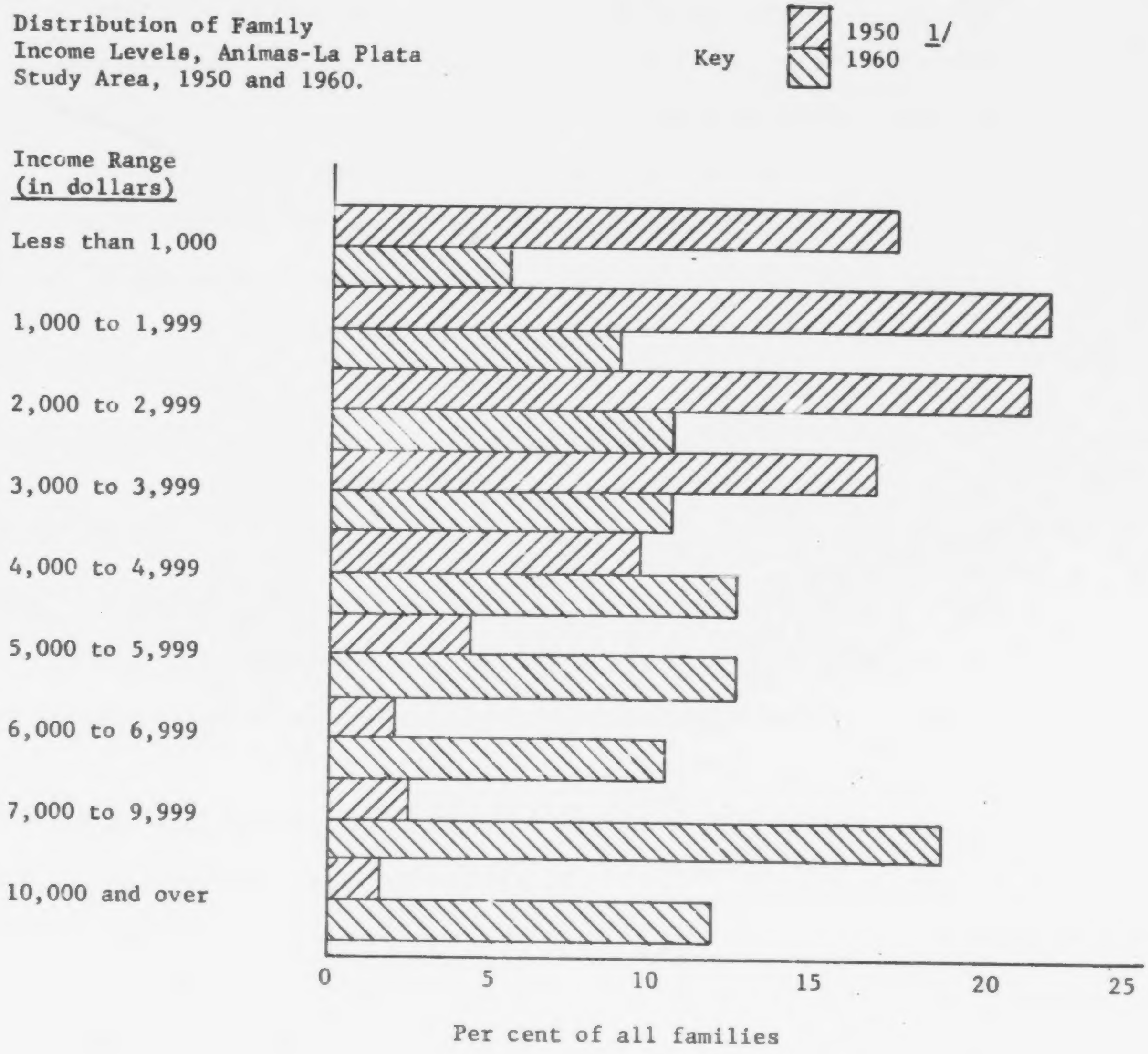
Income Distribution and Payrolls

Family incomes increased significantly during the 1950 - 1960 period. The median rose from $2,446 in 1950 to $5,239 in 1960. While a significant portion of this increase reflects a continuing inflationary trend, a larger portion is due to the upward movement of wages in "real" dollars, as well as an upgrading in the work force as indicated previously by data on occupation.

The distribution of the number of families within various income ranges in 1950 and 1960 is shown in Figure 5. These data show that a complete reversal in income distribution occurred during this period. A higher proportion of the families were included in each of the categories below $4,000 in 1950 than was true in 1960; the opposite was true for the categories above $4,000. The greatest change occurred in the proportion of families included in the $7,000 to $10,000 range; the percentage rose from 2.4 percent of all families in 1950 to 18.7 percent in 1960. On the low end of the income scale, families with less than $1,000 income, the percentage dropped from 17.2 in 1950 to 5.5 in 1960.

Figure 5

Distribution of Family Income Levels, Animas-La Plata Study Area, 1950 and 1960.



1/ Percentages for 1950 do not round to 100 because 3.7 of the families did not report income.

Source: U. S. Census of Population, 1950 and 1960.

Total payrolls reported by major industry categories in 1960 are shown in Table 12. Similar data for 1950 were not readily available so an analysis of changes occurring during the last decade was not made. It seems reasonable to assume, however, that due to the noted increase in total economic activity in the area, significant increases in total payrolls were effected. Average and seasonal hired employment data by each major industry were develoed for the 1960 situation from employment security information. 1/ As a result, average hired employment for 1960 was estimated at 4916 persons. This compares to 5608 hired workers and government workers as reported for April 1960 by the U.S. Census of Population. This can be expected due to differences in obtaining employment data by the various organizations. Period taken, place of residence, group classifications and the like will differ depending upon source of data. Since these tabulations do not cover those persons not included under the employment security law, usually small operations with four or less employees, expansion factors 2/ were applied to the industry groups in order to develop total hired employment and payroll estimates.

Overall seasonality in employment shows a significant increase during the summer season (Table 12). This is particularly evident in certain industries such as construction, food processing and agriculture. Also, those industries related to tourism, such as retail trade and services, show a summer high.

Total labor force, including self-employed persons by sex and within industry groups, is shown in Table 13. The service and retail industries employ not only the largest proportion of the total labor force, 17.8 and 17.7 percent respectively, but have the highest percentage of female employees. The mineral, government and agricultural sectors each

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1/ Colorado Department of Employment, unpublished data, 1960.
2/ Obtained from U.S. Dept. of Labor, Bu. of Labor Statistics, Denver, Colo., unpublished data, March 1960. These data were generalized and therefore served only as a guide for computing total estimates.

Table 12. Seasonal Hired Employment and Payroll by Industry
Animas-LaPlata Study Area 1/
1960

Industry	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Average	Total Payroll
Agriculture													154	326,000
Minerals: Oil and Gas	364	321	329	343	332	334	334	330	320	314	305	298	327	1,769,000
Minerals: All Other	320	328	342	323	315	304	288	278	288	262	283	299	302	2,172,000
Construction	121	119	131	145	158	176	199	202	183	172	163	124	158	752,000
Manufacturing: Food	147	151	144	132	132	114	115	109	114	122	128	125	127	423,000
Manufacturing: Lumber	79	97	85	83	117	94	82	80	86	88	86	90	88	394,000
Manufacturing: All Other	94	95	102	103	97	102	113	105	92	90	86	80	97	419,000
Transportation: Other	137	127	122	122	124	131	132	137	134	154	145	134	133	772,000
Transportation: Railroads													241	1,589,000
Utilities and Communications	315	308	314	322	332	336	334	329	332	324	323	316	324	1,571,000
Wholesale Trade	159	157	155	210	152	150	154	146	147	145	143	147	155	960,000
Retail Trade	858	839	885	976	955	1003	1056	1012	988	960	913	951	950	2,850,000
Finance & Rentals	152	156	141	156	154	151	152	152	152	154	156	154	153	704,000
Services	674	680	606	733	791	830	849	876	800	733	667	660	842	1,186,000
Government													865	3,860,000
Total													4916	19,747,000

1/ Data limited to San Juan and La-Plata Counties, Colorado

Source: Colorado State Department of Employment and estimates by the authors.

Table 13. Total Labor Force by Industry Groups
Animas-LaPlata Study Area 1/

1960

Industry	All Workers 2/			
	Men	Women	Total	Percent
Employed:				
Agriculture	733	25	758	10.5
Minerals	773	28	801	11.1
Manufacturing	313	39	352	4.9
Construction	501	--	501	7.0
Transportation	132	102	234	3.2
Utilities	315	--	315	4.4
Wholesale	158	48	206	2.9
Retail	742	529	1271	17.7
Finance, Real Estate	106	107	213	3.0
Services	558	720	1278	17.8
Government	410	375	785	10.9
Industry Not Reported	53	56	109	1.5
Total Employed	4794	2029	6823	94.9
Unemployed	287	83	370	5.1
	5081	2112	7193	100.0

1/ Data limited to San Juan and LaPlata Counties, Colorado
2/ Includes self-employed persons

Source: U.S. Census of Population

employ approximately 11 percent of the labor force. The wholesale sector, with only 2.9 percent of the labor force, is the smallest industrial sector in terms of employment.

Summary

The Animas-LaPlata study area is typical of much of the Colorado River Basin in that it has a relatively dense population in a limited number of urban centers while other sections are largely uninhabited. The area experienced a 22 percent increase in population during the last decade. A major portion of the present population are new residents. In 1950, only 12 percent of the population reported an out-of-area residence the prior year; by 1960, the percentage rose to almost a third of the population. Overall, out-migration has offset the effects of in-migration in terms of expected population growth.

Observed changes in the sociological and economic characteristics of the population reflect the rapid economic growth which has occurred in the area since World War II. The educational level of people in the 25 year and over age group has climbed from a relatively low level to a point where it now equals the State level and far exceeds the national level. Since 1950, the work force has increased 15 percent overall. Major internal shifts during this period resulted in a 50 percent decline in the farm labor category while the percentage in professional and technical jobs increased sharply. During the same period, the median family income rose from $2,446 to $5,239.

A total payroll of about $19,747,000 was estimated for the study area in 1960. Due to the noted increase in total economic activity, as well as significant increases in family income levels, it is reasonable to assume that the 1960 payroll total is substantially greater than that which was realized in 1950.

Major Resource Oriented Industries

The major resource oriented industries of the study area fall within a category commonly referred to as the producing sector of an economy. Considered in this section of the report are agriculture, recreation (the tourist industry), mineral mining and processing, and manufacturing. The commercial and government activities of the local economy will be discussed in a following section.

Resource oriented industries are of major concern in this evaluation of the local economy since it is oriented to the development of a long range comprehensive water quality management program. The major water users within any economy fall within this group. They are likewise important to a local economy because they provide the major sources of basic income entering the economy from outside the area. It will be noted that within this section recreation is treated as an industry. In the summary section, however, the role of this industry must be handled primarily through its measurable impact on the commercial sectors of the economy. Were it not for the fact that the recreational interests as a group will continue to exert pressure for high quality water, a separate discussion of it as an industry in this section probably would not be warranted.

These four major resource oriented industries[1/] provided employment for an average of 4,460owner operators and hired workers during 1960.

[1/] Includes retail trade and services because of the tourist industries' heavy influence on these commercial activities in the study area.

They accounted for 62 percent of the total labor force of the study area. Payrolls attributable to these four activities amounted to approximately $9,539,000 or 48.3 percent of the total payroll for the area. These industries are discussed separately below:

Agriculture and Forestry

Agriculture and forestry have long been leading basic industries in the study area. In recent years, however, they have declined in importance as other segments of the economy--notably recreation and the oil-gas industries--have expanded rapidly. On-farm agricultural activity is oriented to livestock production. Forestry is concentrated primarily on national forest lands, although a few private land holders provide saw logs to local sawmills on a limited scale.

The agricultural industry was a late comer to the Four Corners region. First came the miners who arrived in the 1860's while this area was still a part of the Ute Indian Reservation. As mining gained in importance, The U. S. Government purchased three million acres of the reservation and opened it up for settlement. The townsite of Durango was laid out on a portion of this purchase and with its establishment as a permanent settlement, farmers and ranchers quickly homesteaded the surrounding area. A peak in the cattle industry was reached by 1877 and continued at this high level until 1887 when a decline in livestock numbers set in. Since the turn of the century, livestock production has remained relatively constant at a reduced level. This has been due in part because of a limit on the number of grazing permits on Federal lands.

Farming Characteristics [1]

On-farm agricultural activity is confined to LaPlata County. The only farming carried on in San Juan County is limited to summer grazing. No farm headquarters have been recorded in the county since 1910 with the exception of a few residential farms reported in 1940 and 1945.

Beef cattle production is the primary activity followed by sheep raising and dairy farming in order of importance. Most of the beef ranches utilize supplemental grazing priveleges on National Forest lands. Farm feeding is required for range stock during the winter and throughout the year for those cattle not permitted on public range because of a shortage of grazing facilities.

Crop production on irrigated land is limited primarily to livestock feed, including alfalfa, improved pasture, wheat, and other small grains. Yields are low because of chronic water shortages which in turn help to discourage the use of fertilizers and other desirable management practices. Some crops on dry land farms are produced for sale, notably wheat and pinto beans, and in unusual wet years irrigated lands also produce excess crops for sale. The dry land farms account for only a small portion of the livestock production in the area.

A summary of agricultural characteristics, as reported by the Census of Agriculture for the 1920 - 1959 period, appears in Table 14. Agricultural activity in this area has changed rapidly during this period of record. The number of commercial farms has declined, for example, from 693 in 1950 to 476 in 1959. [2] While the number of farms

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[1] Data obtained from U.S. Department of Commerce, Bureau of Census, U.S. Census of Agriculture, 1910-1959, U.S. Government Printing Office, Washington, D. C.

[2] Data on the number of commercial farms are not available prior to 1950. The total number of farms declined steadily however, during the 1935-1950 period.

Table 14. Agricultural Characteristics of the Animas-LaPlata Study Area, 1920-1959 1/

Item	1920	1930	1935	1940	1945	1950	1954	1959
AGRICULTURE								
No. of Farms and Acreage								
Total No. of Farms	1,069	1,161	1,245	1,046	936	902	833	677
No. of Commercial Farms	NA	NA	NA	NA	NA	693	566	476
Land in Farms (Acres)	305,003	359,127	328,579	371,480	599,079	933,277	541,979	671,916
Avg. Size of Farms (Acres)	285	309	264	357	640	1,035	651	992.5
No. Farms under 10 Acres	12	NA	NA	36	46	36	57	22
No. Farms 10 to 1000 Acres	1,031	NA	NA	961	803	780	693	556
No. Farms over 1000 Acres	26	NA	NA	49	87	86	83	99
Economic Class								
Commercial Farms								
Class I	NA	NA	NA	NA	NA	22	4	5
Class II	NA	NA	NA	NA	NA	93	70	25
Class III	NA	NA	NA	NA	NA	115	112	92
Class IV	NA	NA	NA	NA	NA	232	210	111
Class V	NA	NA	NA	NA	NA	159	112	161
Class VI	NA	NA	NA	NA	NA	72	58	82
TOTAL COMMERCIAL FARMS	NA	NA	NA	NA	NA	693	566	476
Other Farms								
Part-time	NA	NA	NA	NA	NA	120	105	159
Residential	NA	NA	NA	NA	NA	87	161	38
Other Non-commercial	NA	NA	NA	NA	NA	2	1	1
TOTAL OTHER FARMS	NA	NA	NA	NA	NA	209	267	198
Major Land Use (Acres in Farms)								
Cropland								
Harvested	90,391	57,100	41,816	44,301	59,311	63,261	51,032	44,984
Not Harvested	NA	12,286	22,301	17,583	7,006	12,020	16,952	21,109
TOTAL CROPLAND	NA	69,386	64,117	61,884	66,317	75,281	67,984	66,093
Pasture (woodland excluded)	NA	167,302	103,451	NA	346,520	396,469	269,119	223,274
Woodland (all)	131,326	97,466	108,828	48,463	166,868	438,015	171,270	344,415
All Other	NA	44,973	52,183	NA	19,374	22,512	33,606	38,134
TOTAL LAND IN FARMS	305,003	379,127	328,579	371,522	599,079	932,277	541,979	671,916

1/ Data limited to San Juan and LaPlata Counties, Colorado

Table 14 - continued

Item	1920	1930	1935	1940	1945	1950	1954	1959
Irrigated Land Use (Avgs.)								
Cropland	NA	NA	NA	NA	NA	39,800	31,883	28,386
Pasture	NA	NA	NA	NA	NA	23,412	21,016	29,541
Other	NA	NA	NA	NA	NA	13,404	NA	NA
TOTAL IRRIGATED LAND	63,775	94,532	NA	75,218	61,538 2/	76,616	52,899 2/	57,927 2
Major Crops-All cropland harvested (avgs.)								
Corn	1,693	3,063	1,961	2,071	1,240	1,264	1,177	1,300
Sorghum	--	--	16	59	124	54	11	64
Small Grains	22,942	15,160	11,445	15,874	25,828	31,934	23,878	17,230
All Hay	34,994	31,907	26,079	24,685	28,166	22,333	22,3[illegible]7	20,424
Alfalfa for Seed	NA	NA	NA	327	337	105	107	2
Vegetables & Small Fruits	960	NA	NA	46	26	630	518	81
Landin Orchards & Vineyards	NA	NA	NA	341	407	285	231	157
Major Crops-Irrigated cropland (avgs.)								
Corn	NA	NA	NA	NA	NA	NA	723	1,154
Sorghum	NA	NA	NA	NA	NA	NA	8	--
Small Grains	NA	NA	NA	NA	NA	NA	7,561	7,642
All Hay	NA	NA	NA	NA	NA	NA	12,739	17,814
Alfalfa for Seed	NA	NA	NA	NA	NA	NA	11	--
Vegetables & Small Fruits	NA	NA	NA	NA	NA	NA	7	86
Land in Orchards & Vineyards	NA	NA	NA	NA	NA	NA	192	148
All Other Irrigated Cropland	NA	NA	NA	NA	NA	NA	10,642	1,542
TOTAL	NA	NA	NA	NA	NA	NA	31,883	28,386
Type of Farm								
Field Crop	NA	NA	NA	NA	139	140	82	51
Vegetable-Fruit-Nut	NA	NA	NA	NA	10	--	10	--
Dairy	NA	NA	NA	NA	98	104	128	73
Poultry	NA	NA	NA	NA	33	15	--	6
Other Livestock	NA	NA	NA	NA	311	276	227	311
General	NA	NA	NA	NA	147	158	118	35
All Other	NA	NA	NA	NA	198	209	268	198
TOTAL	NA	NA	NA	NA	936	902	833	674
Farm Real Estate Values								
Total Land & Buildings ($1000)	10,331.3	6,643.3	4,804.8	5,018.8	7,058.9	13,425.4	18,918.3	31,475.1
Avg. per Farm($1000)	6.8	5.7	3.9	4.8	7.5	14.9	22.7	46.5
Avg. Per Acre (Land in Farms)	33.87	18.50	14.62	13.53	11.78	34.60	33.30	45.36
Avg. per Cropland Acre	NA	134.52	74.94	81.10	106.44	176.00	278.28	476.22

2/ Includes land in irrigated farms only

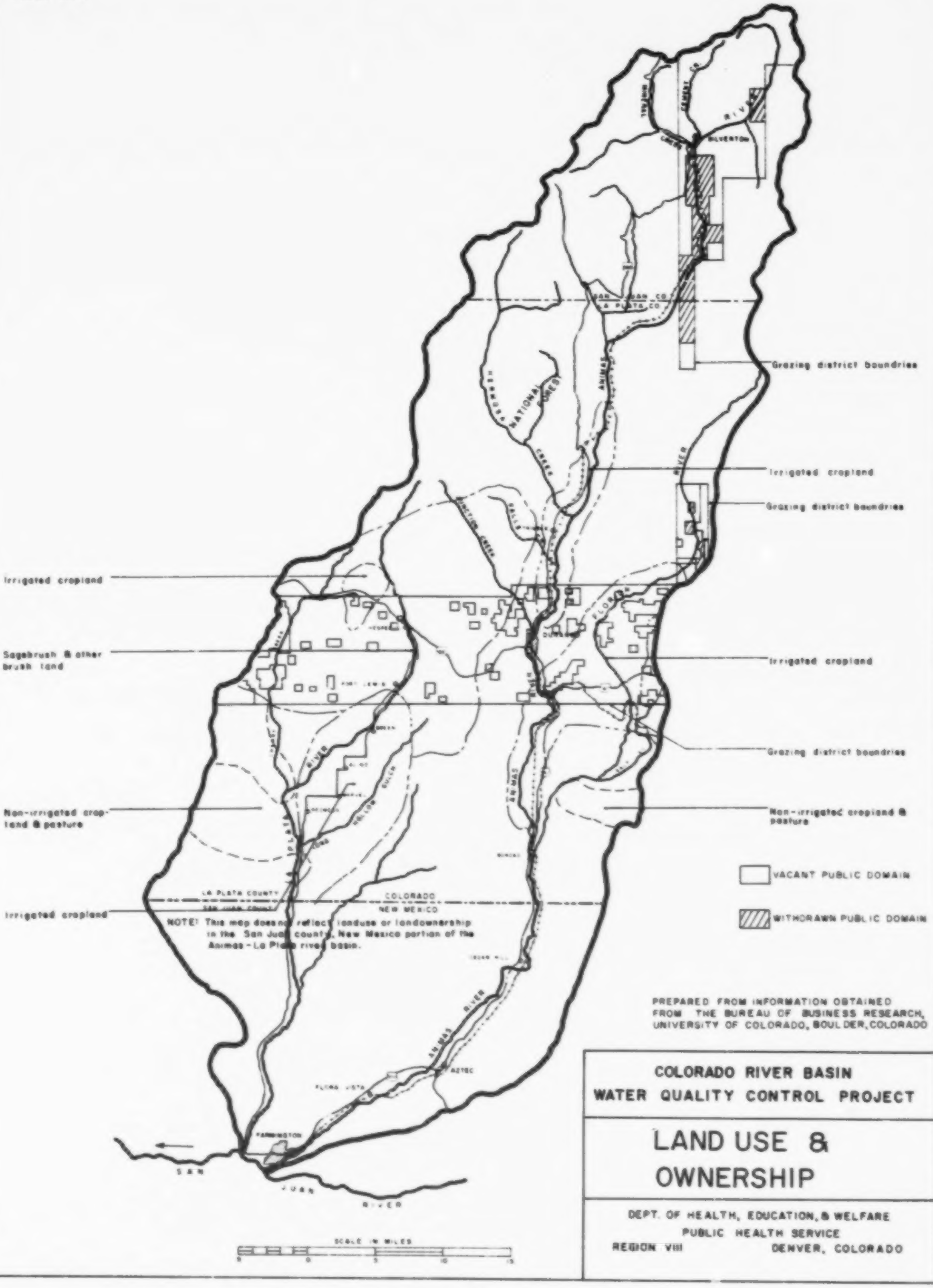
Table 14 - continued

Item	1920	1930	1935	1940	1945	1950	1954	1959
Value of Products Sold ($1,000)								
All Crops	NA	NA	NA	275	486	1,089	845	572
Dairy Products	107	NA	NA	187	477	439	474	682
Poultry Products	38	NA	NA	173	391	142	112	125
Livestock & Other Livestock Products 3/	NA	NA	NA	575	1,255	2,699	1,412	2,642
Forest Products	NA	NA	NA	1	5	24	17	42
TOTAL	NA	NA	NA	1,211	2,614	4,392	2,860	4,063
Livestock on Farms (1,000)								
Cattle and Calves	25.0	18.7	25.4	17.7	22.4	22.3	29.1	28.9
Hogs and Pigs	9.4	3.3	2.6	3.6	4.3	4.0	2.3	1.7
Horses & Mules (all)	7.0	5.2	4.8	4.6	4.1	3.4	2.2	2.0
Sheep and Lambs	42.0	47.3	44.2	37.7	37.2	41.3	34.4	28.1
Laying Hens	41.3	43.5	44.3	39.4	49.0	44.6	42.9	44.5
Turkeys Raised	2.5	NA	NA	10.7	9.0	3.5	2.9	1.0
Farm Utilities								
No. with Electricity	NA	NA	NA	116	444	719	731	NA
No. with Telephone	NA	NA	NA	224	284	385	422	419
No. with Running Water	NA	NA	NA	NA	221	NA	486	NA
Farm Labor								
Farm Operators				NA	789	750	763	582
Unpaid Family				NA	960	496	574	487
Hired-Regular				NA	NA	NA	130	106
Hired-Seasonal				NA	NA	NA	170	48
Total Hired				(322)	(110)	(214)	(300)	(154)
TOTAL FARM LABOR				1,395	1,859	1,460	1,637	1,223
Total Wages Paid ($1,000)					279.0	285.6	313.4	325.7
Level-of -Living Index	NA	NA	NA	61	88	121	135	NA

3/ Excludes dairy and poultry products

Source: U.S. Department of Commerce, U.S. Census of Agriculture, 1959, op cit.

FIGURE NO. 6



Irrigated cropland
Sagebrush & other brush land
Non-irrigated cropland & pasture
Irrigated cropland
Grazing district boundries
Irrigated cropland
Grazing district boundries
Irrigated cropland
Grazing district boundries
Non-irrigated cropland & pasture
VACANT PUBLIC DOMAIN
WITHDRAWN PUBLIC DOMAIN
SILVERTON
CEMENT CR.
RIVER
SAN JUAN CO.
LA PLATA CO.
HERMOSA
NATIONAL FOREST
ANIMAS
CREEK
RIVER
DURANGO
FLORIDA
FORT LEWIS
LA PLATA RIVER
LA PLATA COUNTY
SAN JUAN COUNTY
COLORADO
NEW MEXICO
ANIMAS
ANIMAS RIVER
AZTEC
FLORA VISTA
FARMINGTON
SAN JUAN RIVER
SCALE IN MILES
0
5
10
15

NOTE! This map does not reflect landuse or landownership in the San Juan county, New Mexico portion of the Animas - La Plata river basin.

PREPARED FROM INFORMATION OBTAINED FROM THE BUREAU OF BUSINESS RESEARCH, UNIVERSITY OF COLORADO, BOULDER, COLORADO

COLORADO RIVER BASIN
WATER QUALITY CONTROL PROJECT

LAND USE & OWNERSHIP

DEPT. OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION VIII DENVER, COLORADO

Permit figures by individual counties are unavailable so it is not possible to determine exactly what proportion of the above totals can be credited to the study area.

Some use of timber products under free-use timber permits is made by residents in the area but the commercial value of these products is extremely small. Only 637 such permits, with a total value of $743.45, 1/ were issued in 1960 for the state as a whole. Legislation was enacted in 1947 to permit the sale of timber products from public lands. Since then timber sales from BLM lands in the study area have been contributing to the local sawmill and lumbering industries. The 1960 revenue from timber sales for the state as a whole totaled $107,671.

National Forest Lands

The study area includes approximately 31 percent of the 1,849,767 acres in the San Juan National Forest. This acreage accounts for approximately two-thirds of San Juan County and one-third of LaPlata County. Applicable data on agricultural activity in the study area portion of the forest are not readily available but some rough approximations are possible by assuming a proportionate share of activity relative to the percentage of the forest area that lies within the study area (Table 15).

The San Juan National Forest is probably the most economically significant one in Colorado: "The most important of the forests is the San Juan, containing somewhat over 1/4 of the timber (in the state)--largely Engleman Spruce." 2/ The study area contains approximately 393,000 forested acres, assuming a more or less uniform distribution of the forested acreage, and has at least 2 billion feet of standing timber. Lumber production in the National forest portion of the study

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1/ Ibid

2/ W.L. Heuser. An Analysis of the Feasibility of Enlarging the Downtown Shopping Facilities, Durango, Colorado, op.cit. p. 33.

area is a major enterprise. An estimated 10 million board feet were cut in 1951 and since 1956 an average sustained yield of 15 million board feet has been maintained, the annual mill value of which would be well over one million dollars. 1/ In addition, an appreciable amount of dead timber is used by residents of the area for fencing, fuel and the like. Some Christmas trees are also harvested.

National Forest lands play a significant role in the livestock industry of the study area. An estimated 100 ranchers graze some 6,000 cattle and 25,000 sheep on these lands annually. The total number of animal grazing units has decreased slightly in recent years as more consideration has been given to optimum rangeland management. It is likely to remain at the present levels during the forseeable future, however, and may even increase slightly.

The economic and ethnic values of the San Juan National Forest are not limited solely to agricultural activity. The recreational assets, for example, are of tremendous value and will be discussed in greater detail in a subsequent section of this report. In addition, the forests provide favorable conditions for optimum water yields of relatively high quality and contribute approximately 25 percent of the income received in the study area for school and road purposes. 2/

Indian Lands

Some 194,000 acres of the Ute Indian Reservation are included in the LaPlata County, Colorado portion of the study area. In addition, a large portion of San Juan County, New Mexico lies within the Navajo

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1/ This would be a conservative figure based on an assumed price of $70/M. In recent years the price has varied from $71 to $79/M.

2/ W.L. Heuser, An Analysis of the Feasibility of Enlarging the Downtown Shopping Facilities, Durango, Colorado, op. cit.

Table 15. An Approximation of the Contribution of the San Juan National Forest to the Agricultural Economy of the Animas La Plata Study Area, 1950 and 1960

Item	Total San Juan National Forest		Study Area Portion[1/]	
	1950	1960	1950	1960
Timber Resources and Production				
Total National Forest Acreage	1,849,767	1,849,767	567,436	567,436
Total Forested Acreage	1,268,000	1,268,000	393,000	393,000
Standing Timber (board feet)	6 billion	6 billion	2 billion	2 billion
Timber Production (board feet)	33 million	50 million	10 million	15 million
Timber Production Value	2.3 million	3.4 million	.7 million	1.1 million
Grazing				
Number of Operators with permits	300	NA	100	NA
Number of Cattle Grazed	21,000	20,000	6,500	6,200
Number of Sheep Grazed	100,000	80,000	31,000	25,000
Acres of Grazing Land	200,000	NA	62,000	NA

Source: Data for the San Juan National Forest as a whole obtained from: U. S. Department of Agriculture, Forest Service Maps, The San Juan National Forest, issued in 1953 and 1961.

[1/] Data for the Study Area Portion were not available directly; the figures shown were developed proportionately to the percentage of total National Forest Area which lies in the Animas-LaPlata study area, limited to San Juan and LaPlata Counties, Colorado.

Indian Reservation. Agriculture is a major source of income on Indian lands although its relative importance has declined in recent years due to income received from oil and mineral royalties. Detailed agricultural data were not available for the Indian portion of the study area. The only item available is in regard to probable future irrigation development. In a letter dated April 28, 1961, the Gallup area office of the Bureau of Indian Affairs requested that the Animas-LaPlata Project proposed by the Bureau of Reclamation include some 17,200 acres of irrigable lands in the Ute Mountain Indian Reservation, Southern Ute Indian Reservation and in individual Indian allotments. 1/ The Bureau's feasibility report for the Animas-LaPlata Project indicates that these lands were subsequently included in the development plan. 2/ An evaluation of proposed irrigation development projects in the study area follows below.

Proposed irrigation Development

The authorization of the Colorado River Storage Project by Congress on April 11, 1956 paved the way for expansion of irrigated agriculture throughout the Upper Basin Division of the Colorado River Basin. 3/ Two projects planned within the study area as a result of this enabling legislation - the Animas-LaPlata and Florida Projects - will have a direct impact on local agricultural development. The Bureau of Reclamation released their feasibility report for the Animas-LaPlata Project in May 1961 and Congressional authorization for construction is pending 4/

1/ Assistant Area Director, Gallup Area Office, Bureau of Indian Affairs, in a letter of April 28, 1961 to the Regional Director, Bureau of Reclamation, Region 4, Salt Lake City, Utah.

2/ U.S. Department of Interior, Bureau of Reclamation, Region 4, Feasibility Report: Animas-LaPlata Project, Salt Lake City, Utah, May 1961.

3/ U.S. Department of Interior, Bureau of Reclamation, The Colorado River Storage Project and Participating Projects, U.S. Government Printing Office, Washington, D.C., 1959.

4/ Feasibility Report; Animas-LaPlata Project, op cit.

The Florida project, which would receive additional water from the Animas-LaPlata project, is now under construction. Data on various components of these two projects are summarized in Table 16. 1/ For the most part, the areas that would be brought under irrigation as a result of these two projects lie within the study area. The general location of proposed supplemental and full irrigation lands are shown in Figure 7.

Animas-LaPlata Project 2/

The Animas-LaPlata project was planned to develop flows of the Animas and LaPlata River systems for irrigation, recreation, fish and wildlife conservation and for municipal and industrial use in Durango, Colorado. Key project features are the proposed Howardsville Reservoir upstream from Silverton on the Animas River and the Animas Diversion Canal, which would provide at least part of the water for every phase of the development. Releases from Howardsville Reservoir, along with direct streamflow accruing below the reservoir, would be turned into the Animas Diversion Canal at the proposed Teft Diversion Dam about eight miles downstream from the San Juan-LaPlata County line.

Municipal and industrial water for Durango is to be obtained from the Animas Diversion Canal supplemented by water from Junction Creek and Falls Creek that would be regulated in the proposed Animas Mountain Reservoir about 5 miles north of the city. Part of the supply would be available for increased use by Durango and part would replace the city's existing supply now largely obtained from the Florida River. After this

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1/ Ibid

2/ The discussion of the Animas-LaPlata Project, and in part that of the Florida Project, was summarized from the Animas-LaPlata Feasibility Report with the consent of Mr. William F. Crabtree, Project Manager, Durango Project Office, Bureau of Reclamation, U.S. Department of Interior.

Table 16. General Characteristics of the Proposed Animas-La Plata and Florida Projects.

Item	Colorado	N. Mexico	Total
IRRIGABLE AREA (acres)			
Animas-La Plata Project			
Full service land			
Non-Indian	29,600	12,100	41,700
Indian	14,600	2,600	17,200
Subtotal	44,200	14,700	58,900
Supplemental service land			
Non-Indian	20,100	5,500	25,600
Total	64,300	20,200	84,500
Acreage by land class			
Class 1	5,300	2,100	7,400
Class 2	51,700	11,700	63,400
Class 3	7,300	6,400	13,700
Total	64,300	20,200	84,500
Florida Project			
Acreage in basic plan (all to receive additional water)	19,450	---	19,450
Acreage added to basic plan			
Full service land	1,110	---	1,110
Supplemental service land	1,170	---	1,170
Subtotal	2,280	---	2,280
Total	21,730	---	21,730
WATER SUPPLY (Avg. Ac. Ft. Annually)			
Animas-La Plata Project			
Irrigation supply			
Diversion requirements	182,800	71,500	254,300
Water within requirements			
Without project	11,300	7,600	18,900
Project increase	163,000	62,300	225,300
Total (With Project)	174,300	69,900	244,200
Municipal and industrial supply			
Without project	6,500	---	6,500
Project increase	9,200	---	9,200
Total (with Project)	15,700	---	15,700
Increased depletion of the Colorado River	92,450	34,100	126,550

Table 16 - continued

WATER SUPPLY - Cont'd	Colorado	N. Mexico	Total
Florida Project			
Increased irrigation supply			
For acreage in basic plan	700	- -	700
For acreage added to plan	3,000	- -	3,000
Total	3,700	- -	3,700
Increased depletion of the Colorado River	2,050	- -	2,050
AGRICULTURAL ECONOMY			
Principal production.	Alfalfa, small grains, pasture, beef, dairy and sheep		
Development period (years)			
McDermott and Meadows areas			10
LaPlata, Colorado area			5
LaPlata, New Mexico area			
Full service lands			10
Supplemental service lands			3
Dry Side area			8
Florida project			5
Gross farm income	$4,416,400	$1,547,400	$5,963,800
Farm expense	2,674,300	975,800	3,650,100
Net farm income	1,742,100	571,600	2,313,700
Payment capacity			
Animas-LaPlata project	423,900	123,300	547,200
Florida project	5,300	- -	5,300
Total	429,200	123,300	552,500
Operation and maintenance costs	216,400	61,100	277,500
Amortization capacity and recommended annual installment			
Total	212,800	62,200	275,000
Avg. per acre-foot	1.30	1.00	1.20
Direct annual benefits 1/	1,246,900	377,000	1,623,900
Total annual benefits 1/	2,771,900	870,200	3,642,100

1/ Adjusted for development periods

Table 16 - continued

PROJECT FEATURES

Diversion Dams	Teft	LaPlata	Meadows
Location	Animas River	LaPlata River	LaPlata River
Type of structure	Concrete gravity	Concrete gravity	Concrete gravity
Capacity of headworks	600	400	165

Canals and Conduits	Length (miles)	Initial capacity (sec.-ft.)
Animas Diversion	47.6	600
McDermott	33.4	230
Red Mesa	10.0	235
Dry Side	14.1	625
Ponds	11.5	175
Ute	22.2	195
Meadows Diversion	10.6	165
Meadows	11.1	90

Laterals	Number	Combined length (miles)	Initial capacity (sec.-ft.)
Animas Diversion Canal	11	45.0	40 to 5
McDermott	18	59.0	50 to 5
Red Mesa	17	68.0	34 to 7
Dry Side	14	56.2	60 to 7
Ponds	8	45.0	80 to 8
Ute	5	22.0	30 to 15
Meadows Diversion Canal	3	12.3	20 to 5
Meadows	9	23.6	40 to 5
LaPlata, N. Mex.	2	7.4	20

Drains	Length (miles)
Deep closed drains	71
Deep open drains	5
Improved natural channels	20
Shallow surface drains	11
Levees	26
Flood Channels (miles)	9.4

Table 16 - concluded

OVERALL BENEFIT-COST ANALYSES (Unit--$1,000)

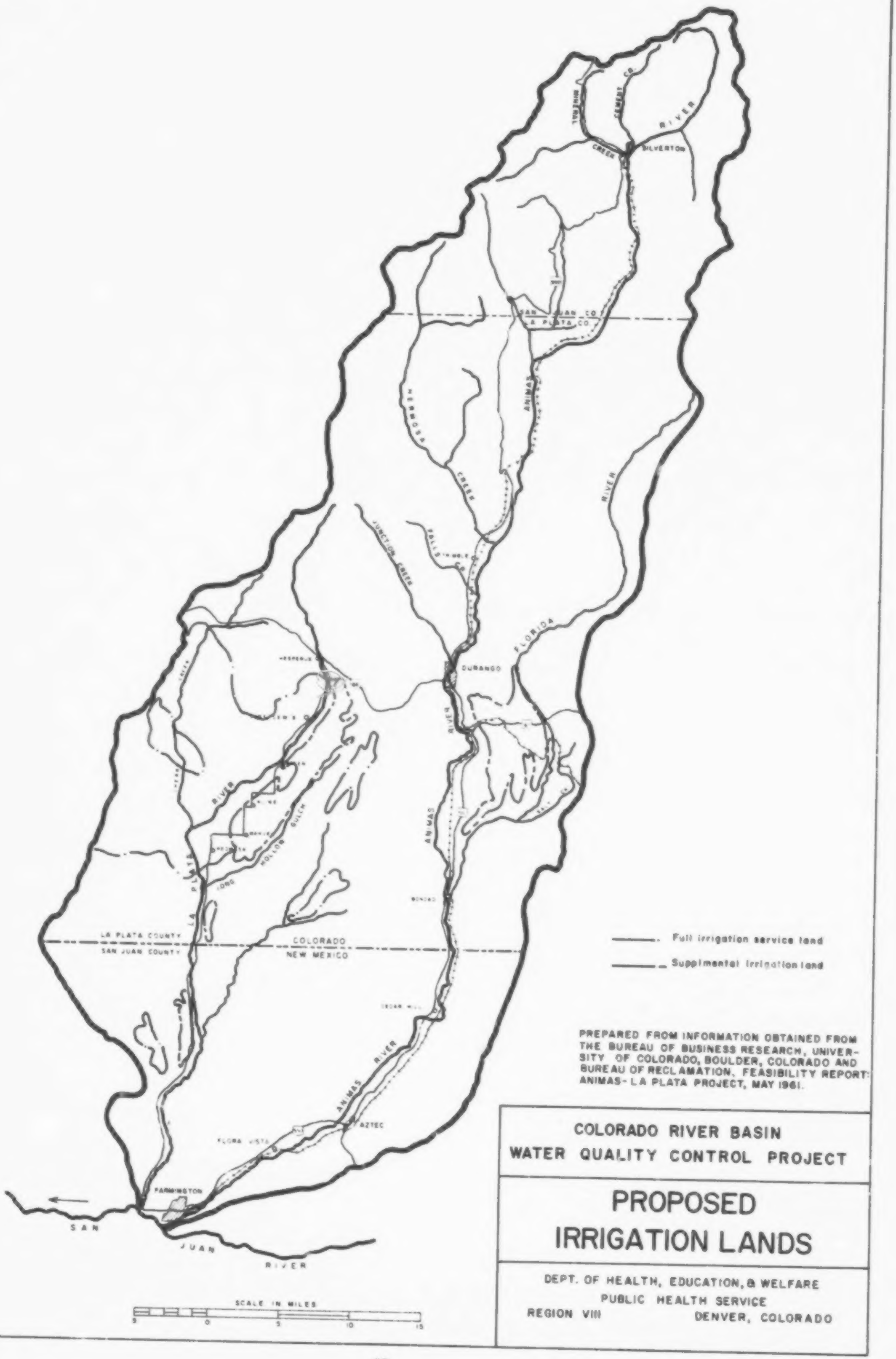
	Irrigation	Municipal and industrial use	Fish and wildlife	Recreation	Total
100-year period of analysis at 2 1/2 percent interest					
Average annual equivalent costs					
Project investment	2,748.5	68.6	83.0	1/ 20.4	2,920.5
Operation and maintenance costs	277.5	1.1		18.9	297.5
Colorado River Storage project costs 2/	247.4	9.8			257.2
Total	3,273.4	79.5	83.0	39.3	3,475.2
Average annual benefits					
Direct	1,623.9	80.5	89.6	123.2	1,917.2
Indirect	1,127.0				1,127.0
Public	891.2				891.2
Total	3,642.1	80.5	89.6	123.2	3,935.4
Benefit-cost ratios					
Direct benefits only	0.50:1	1.01:1	1.08:1	3.13:1	0.55:1
Total benefits	1.11:1	1.01:1	1.08:1	3.13:1	1.13:1
50-year period of analysis at 2 5/8 percent interest					
Average annual equivalent costs					
Project investment	3,646.3	91.0	110.2	1/ 20.7	3,868.2
Operation and maintenance costs	277.5	1.1		18.9	297.5
Colorado River Storage project costs 2/	247.4	9.8			257.2
Total	4,171.2	101.9	110.2	39.6	4,422.9
Average annual benefits					
Direct	1,578.3	102.6	89.6	123.2	1,893.7
Indirect	1,094.7				1,094.7
Public	865.8				865.8
Total	3,538.8	102.6	89.6	123.2	3,854.2
Benefit-cost ratios					
Direct benefits only	0.38:1	1.01:1	0.81:1	3.11:1	0.43:1
Total benefits	0.85:1	1.01:1	0.81:1	3.11:1	0.87:1

1/ Recreation costs amortized over 25-year period.

2/ Costs based on $2 for each acre-foot of average annual increase in depletion of Colorado River resulting from project development.

Source: U.S. Department of Interior, Bureau of Reclamation, Region 4, Feasibility Report: Animas-LaPlata Project, Salt Lake City, Utah, May 1961.

FIGURE NO. 7


MINERAL
CEMENT CR.
RIVER
CREEK
SILVERTON
SAN JUAN CO.
LA PLATA CO.
HERMOSA
CREEK
ANIMAS
RIVER
JUNCTION CREEK
FALLS
TRIMBLE
FLORIDA
DURANGO
HESPERUS
RIVER
LA PLATA
HOLLOW GULCH
LONG
ANIMAS
RIVER
BONDAD
LA PLATA COUNTY
SAN JUAN COUNTY
COLORADO
NEW MEXICO
CEDAR HILL
ANIMAS
RIVER
AZTEC
FLORA VISTA
FARMINGTON
SAN
JUAN
RIVER
Full irrigation service land
Supplemental irrigation land
SCALE IN MILES
5
0
5
10
15

PREPARED FROM INFORMATION OBTAINED FROM THE BUREAU OF BUSINESS RESEARCH, UNIVERSITY OF COLORADO, BOULDER, COLORADO AND BUREAU OF RECLAMATION, FEASIBILITY REPORT: ANIMAS- LA PLATA PROJECT, MAY 1961.

COLORADO RIVER BASIN
WATER QUALITY CONTROL PROJECT

PROPOSED IRRIGATION LANDS

DEPT. OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION VIII DENVER, COLORADO

exchange, additional water would be available from the Florida River for the Florida project now under construction. This water would slightly increase the supply for presently irrigated lands in the basic Florida project plan and also would permit additional lands to be brought under irrigation.

A dependable water supply is the most urgent need of the project area. It is essential to the expansion of irrigated acreage, the stabilization of agriculture on presently irrigated lands, and the continued development of other sectors of the local economy. The feasibility report stresses the fact that because of the great seasonal and yearly fluctuations in river flow, the additional water needed can be obtained only through construction of regulatory reservoirs. [1]

Practically all the land now irrigated is in need of supplemental water during the later part of the growing season. Good quality lands without irrigation are now mostly idle and those portions used for dry farming are producing only a small part of their potential. Dry farming in the area appears to be a speculative venture at best and in years of low rainfall, investments in dry lands are almost a total loss. The livestock industry is presently operating at a static level because of shortages of winter feed supplies and full capacity use of National Forest and Taylor grazing lands. High transportation costs make it impracticable to import additonal feed into the area. Many farmers are now working off the farm part-time to supplement their income. As a result, a growing number of small farms are inefficiently operated.

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[1] U.S. Department of Interior, Bureau of Reclamation, Feasibility Report; Animas-LaPlata Project, op cit.

With project development, the farm pattern presently practiced on irrigated lands in the LaPlata, Colorado and San Juan, New Mexico areas would probably be adopted throughout the project area. Production of beef cattle, dairy cattle, and sheep would be the primary enterprises, supported by field production of alfalfa, small grain, and pasture. Production of pinto beans and wheat by dry land farming methods would probably be abandoned. The increased livestock production would have to consist entirely of livestock fed on the farm since the Federal rangeland resources are already used to capacity. Production per head would not change materially from that in presently irrigated areas but the overall number of farm livestock in the area would be greatly increased. Per acre crop yields would be substantially higher than on presently irrigated lands because availability of late season water would permit crops to be brought to full maturity. Assurance of such water would also encourage better crop rotation and land fertilization practices.

Existing land ownership in the project area presently range in size from less than 100 acres to more than 1,100 acres. A substantial amount of this land is now held in large ownerships, primarily because of the extensive type of agriculture followed in areas of sparse rainfall and inadequate irrigation supplies.

Under existing reclamation law, project water could be delivered to a maximum of 160 acres of irrigable land in single ownership or 320 acres in joint ownership. As a result, about 450 new farms could be developed with the project.

The actual number of new farms, however, is expected to be between 250 and 350, depending upon Indian settlement allowed by the Bureau of Indian Affairs and of private owners as influenced by reclamation law. New farms in the LaPlata River area of Colorado would be formed primarily from the division of current large holdings among farm families. Settlement opportunities for families from outside the area would probably be held to a minimum.

Florida Project 1/

Development of the Florida Project facilities is currently underway by the Bureau of Reclamation as a participating project of the Colorado River Storage Project. Construction of Lemon Reservoir began during the summer of 1961. With the completion of the project, 25,740 acre-feet of water from the Florida River will be made available for adequate irrigation of 19,450 acres of land in the Florida Mesa area of LaPlata County. Approximately 13,700 acres of this total are presently under limited irrigation due to inadequate supplies. Some 7,500 acres of new irrigation land will be developed.

The Florida River water will be regulated at the 40,300 acre-foot Lemon Reservoir and released to the river as needed for irrigation downstream. The distribution system will utilize the existing Florida Canal and Florida Farmers Ditch but they will require enlargement and extension. Some additional laterals will have to be constructed as the irrigation area is fully developed.

1/ The description of the Florida Project is excerpted from the following reports: U.S. Department of Interior, Bureau of Reclamation, Feasibility Report: Animas-LaPlata Project, op cit. and U.S. Department of Agriculture, Florida Project: A Report of Reappraisal of Direct Agricultural Benefits and Project Impacts, Salt Lake City Utah, August 1959.

Several studies of irrigation requirements have been made in the general vicinity of the Florida Project. [1] These have shown that during years of low runoff, past water supply shortages have been in excess of 50 percent of requirements. Based on a weighted average net seasonal consumptive use of 1.28 acre-feet per acre, and an estimated weighted average farm irrigation efficiency of 53 percent, the average water requirement at the farm headgate, assuming full development, will be 2.42 acre-feet per acre. Based on a period comparable to 1928-1956, the proposed facilities will deliver an average of 2.28 acre-feet of irrigation water at the farm headgate which amounts to meeting 94 percent of the average water requirements. A 100 percent water supply will be available for project lands on an average of 7 out of 10 years.

With the proposed development, farming in the project area is expected to become similar to other areas in the San Juan River Basin where adequate irrigation water is now available. Most of the land is expected to be used for livestock feed production. Some 3,350 acres of land to be developed for irrigation lie in continuous tracts and will provide an opportunity for the establishment of new farms. The remaining 2,380 acres lie in small, scattered tracts on existing farms.

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[1] Among these studies are: 1) Appendix B, Record of the Upper Colorado River Basin Compact Commission; 2) H.F. Blaney and W.D. Criddle, Consumptive Use and Irrigation Water Requirements of Crops in Colorado; and 3) H.F. Blaney and W.D. Criddle, Consumptive Use of Water in the Irrigated Areas of the Upper Colorado River Basin. Additional related information is contained in the Water Supply Papers of the U.S. Geological Survey, Climatological Data compiled by the U.S. Weather Bureau and in Colorado Heat and Moisture Indexes for Use in Land Capability Classification by the Soil Conservation Service.

Estimates of returns with the project vary by type of land to be developed. The weighted average for the entire 19,450 acres is $11.24 per acre, or about $219,000 annually. Benefits from the use of supplemental water are expected to begin to accrue immediately after completion of the project. It was assumed that a period of three years will be required before the full level of projected benefits are achieved on the presently irrigated and intermingled new lands and that five years will be required for the lands on which new farms are projected.

Summary

It seems reasonable to conclude that the future expansion of the irrigated agriculture in the study area will develop and that it will be closely geared to proposed projects of the Bureau of Reclamation. The marked decline in agriculture during the post-war period was restricted primarily to dry farming activity. Further declines in this type of farming are likely to continue as more and more of the marginal land now under cultivation is abandoned, but this will probably be offset to some extent by the proposed irrigation developments.

Some additional reduction in certain components of the agricultural sector is likely to occur, however, as a result of the expanding outdoor recreation industry. Conversion of a commercial livestock operation into a "dude ranch" serves as an example of this type of impact. Expanding industrial and urban activities in areas adjacent to Durango and Farmington will also require further declines in the agricultural picture. The net gain may be considerably less than the addition of some 100,000 acres of fully irrigated land in the agricultural sector would indicate.

Outdoor Recreation and Tourist Industries

The study area is in the center of a region widely known and extensively used for outdoor recreational activities. It is rapidly gaining distinction as one of the leading tourist-drawing areas in Colorado. This is due in part to a vast store of natural scenic attractions and to relatively well developed tourist facilities (Figure 8).

Recreation is a rapidly growing activity of considerable economic importance for the state as a whole. Professor L.J. Crampon of the University of Colorado estimates that the number of tourists visiting the state has increased from 3,878,000 in 1956 to 5,182,000 in 1961 (Table 17). 1/

Present Economic Value

Estimated recreational expenditures in Colorado rose from approximately $225,816,000 in 1956 to $408,000,000 in 1961 (Table 17)2/ The 1961 figure represents slightly over 2 percent of the estimated 20 billion spent nationally. 3/ One writer recently made the following observation in regard to Colorado's recreation and tourist industries: "Apparently tourists are worth more 'per head' to the state's economy than cattle are--the total value of cattle in the state in the 1957 inventory was only $166,706,000.....This fact should be borne in mind relative to the public policy implications involved in such problems as private posting of access to public streams, National Forests, and other recreational areas". 4/

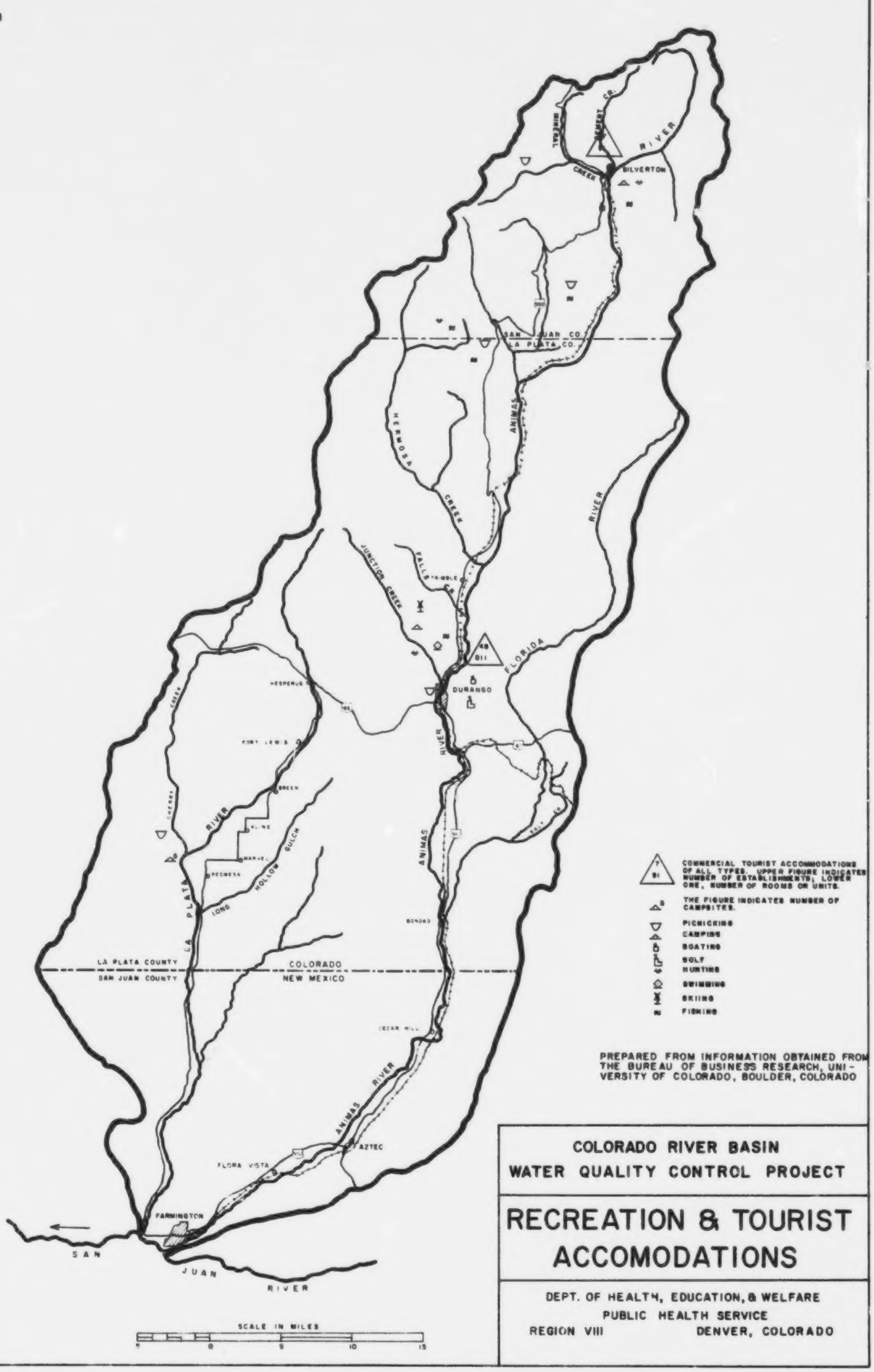
1/ Estimates obtained through personal contact with Professor Crampon and by reference to his numerous publications on this subject.

2/ Ibid

3/ Outdoor Recreation Resources Review Commission, Outdoor Recreation For America, U.S. Government Printing Office, Washington, D.C., Jan. 1962, p4.

4/ W.L. Heuser, An Analysis of the Feasibility of Enlarging Downtown Shopping Facilities, Durango, Colorado, op cit. p. 44.

FIGURE NO. 8


MINERAL CREEK
CEMENT CR.
RIVER
SILVERTON
ANIMAS
SAN JUAN CO.
LA PLATA CO.
HERMOSA CREEK
FLORIDA RIVER
JUNCTION CREEK
FALLS CREEK
TRIMBLE
DURANGO
HESPERUS
CHERRY CREEK
FORT LEWIS
BREEN
KLINE
MARVEL
REDMESA
LA PLATA RIVER
LONG HOLLOW GULCH
ANIMAS RIVER
BONDAD
LA PLATA COUNTY
SAN JUAN COUNTY
COLORADO
NEW MEXICO
CEDAR HILL
AZTEC
FLORA VISTA
FARMINGTON
SAN JUAN RIVER
COMMERCIAL TOURIST ACCOMMODATIONS OF ALL TYPES. UPPER FIGURE INDICATES NUMBER OF ESTABLISHMENTS, LOWER ONE, NUMBER OF ROOMS OR UNITS.
THE FIGURE INDICATES NUMBER OF CAMPSITES.
PICNICKING
CAMPING
BOATING
GOLF
HUNTING
SWIMMING
SKIING
FISHING
SCALE IN MILES
5
0
5
10
15

PREPARED FROM INFORMATION OBTAINED FROM THE BUREAU OF BUSINESS RESEARCH, UNIVERSITY OF COLORADO, BOULDER, COLORADO

COLORADO RIVER BASIN
WATER QUALITY CONTROL PROJECT

RECREATION & TOURIST ACCOMODATIONS

DEPT. OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION VIII DENVER, COLORADO

Table 17. Estimated Number of Tourists and Total Annual Expenditures in Colorado, 1956 - 1961.

Year	Number of Tourists	Total Annual Expenditures
1956	3,878,000	$ 225,816,000
1957	3,909,000	261,757,000
1958	4,095,000	303,562,000
1960	4,979,000	392,000,000
1961	5,182,000	408,000,000

Source: Estimates provided by Dr. L. J. Crampon, Director, Bureau of Business Research, University of Colorado, Boulder, Colorado during a visit to his office, February 23, 1962.

What was the study area's share of the state's booming recreation business? There is no precise way presently available to answer this question but numerous data were on hand upon which to build some reasonable estimates. Overall, it was determined that recreational activities contributed approximately $4 million to the local economy during 1960 (Table 18). Five major segments of the industry were considered in the development of this estimate: 1) Tourism; 2) The nationally famous narrow-guage railroad between Durango and Silverton; 3) Big Game Hunting; 4) Skiing; and 5) Other miscellaneous forms of recreational activities.

Tourist Trade

Over 200,000 people visited Mesa Verde National Park in 1958 (the most recent year for which figures were available) and almost that many visited the San Juan National Forest and the current annual rate is certainly not less. Due to the central location of Durango, relative to these two recreational areas, and because of its excellent lodging and other tourist facilities, it can safely be assumed that a large number of them spend a portion of their time in the study area (Table 19).

If it is assumed that these 200,000 tourists spent 50 percent of their total expenditures in the study area during their trip, a rough approximation of the dollar value of their contribution to the local economy can be developed. According to one available estimate, the average tourist visiting Colorado stays for 7.4 days and spends an average of $7.87 a day. 1/ If it is assumed that the average visitor to

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1/ Colorado Business Review, Vol. XXX, No. 5, University of Colorado, Boulder Colorado, May 1957, pp. 1-2.

Table 18. Estimated Expenditures for Outdoor Recreational Activities in the Animas-LaPlata Study Area, 1960.

Type of Activity	Expenditures	
	Dollars	Percent
Summer Tourists	$ 2,361,000	57.7
Narrow-guage Railroad Trip	743,400	18.1
Big Game Hunting	317,300	7.7
Skiing	23,300	.6
All Other Outdoor Recreation	650,000	15.9
Totals	$ 4,095,000	100.0

Source: Estimates prepared by the authors on the basis of fragmented data available on a state and local basis.

Table 19. Major Visitor Accomodations in the Animas-LaPlata Study Area, 1960.

Location and Type	Motels	Hotels	Resorts 1/	Trailer Courts	Grand Total	Tourist Total 2/
Durango						
Est. or Areas	40	7	3	18	68	48
Rooms or Units	551	246	28	331	1,156	811
Bayfield 3/						
Est. or Areas	18	1	6	12	37	27
Rooms or Units	135	6	44	57	242	200
Hesperus						
Est. or Areas	1	0	0	0	1	1
Rooms or Units	10	0	0	0	10	10
Ignacio 3/						
Est. or Areas	3	1	0	3	7	2
Rooms or Units	9	10	0	8	27	15
Silverton and Vicinity						
Est. or Areas	5	2	1	2	10	7
Rooms or Units	38	62	6	15	121	97

1/ Includes all seasonal and similar resorts, dude and guest ranches, resort hotels and the like.
2/ Includes only those commercial units or rooms classified as used primarily by temporary visitors.
3/ Both Bayfield and Ignacio are located outside the drainage area but since whole county data are used, they are included in the summary.

Source: Bureau of Business Research, University of Colorado, Local Area Statistics Series, "LaPlata County" and "San Juan County", Prepared for the Resources and Community Development Division of the Colorado Department of Employment, Boulder, Colorado, 1962.

southwestern Colorado spends three days in this area--not an unreasonable assumption considering the large number of attractions to be enjoyed locally. 1/ The average tourist would then have spent $23.61, and the group as a whole would have spent $4,722,000. If the 50 percent rate of total expenditures is applied, an estimate of $2,361,000 spent in the study area is calculated.

The Narrow-Guage Railroad

A 1958 survey indicated that 31,750 people made the Durango-Silverton scenic trip on the narrow-gauge line of the Denver, Rio Grande and Western Railroad that year. 2/ According to this survey, these tourists spent an average of $20.65, or a total expenditure of approximately $655,637, in Durango and Silverton while making the trip. In 1960, the number of passengers making this trip had risen to 36,000.3/ If we apply the average expenditure of $20.65 as reported in 1958 to the number of passengers reported in 1960 we arrive at a conservative estimate of a total expenditure of $743,400. It should be noted that only about 25 percent of this total was actually spent on train fare. The remainder entered the local economy through the retail trades.

Big Game Hunting

Data on expenditures by hunters in the area are also unavailable but enough information at the state level exists so that an estimate can be computed. Although small game, ducks and geese are hunted by local sportsmen, the major revenue produced from hunting is limited to deer and elk.

1/ W.L. Heuser, op. cit. p.45

2/ Durango Herald News, September 23, 1958, p. 1

3/ U.S. Department of Agriculture, Forest Service, Forest Service Map: The San Juan National Forest, Rocky Mountain Region, Denver, Colorado, 1961.

Ready access to good hunting areas is almost unlimited. During the 1960 season, for example, LaPlata County ranked fifth in the state in terms of the number of elk harvested. 1/ Most of the hunting is concentrated in the San Juan National Forest. In recent years the Southern Ute Indian Reservation has also been open to hunting under special permit.

The combined kill for San Juan and LaPlata Counties in Colorado in 1960 totaled 2,357 deer and 682 elk. 2/ An overall success ratio of 67 percent for deer and 27.5 percent for elk was achieved. 3/ With these data on hand it can be assumed that there were some 3,135 deer hunters and 1,176 elk hunters in the study area in 1960. Approximately 25 percent of these hunters were from out-of-state. 4/

According to data compiled by the Colorado Department of Game and Fish, resident and non-resident hunters respectively spent an average of $82.65 and $289.02 during the 1959 season. 5/ During the same period, resident and non-resident elk hunters respectively spent an average of $115.87 and $378.79. 6/ These figures reflect all expenses incurred in association with the hunting trips carried out during the season with the exception of license fees. The above data also indicated that approximately 40 percent of the total was spent on clothing and equipment. The remaining 60 percent was spent for meals, lodging,

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1/ Colorado Department of Game and Fish, Big Game Management in Colorado, 1949-1958, Tech. Bul. No. 8, Denver, Colorado, December 1961, p.108.

2/ Unpublished data obtained from the Colorado Department of Game and Fish, telephone conversation, February 16, 1962.

3/ Big Game Management in Colorado, 1949-1958, op cit., p. 112.

4/ Ibid

5/ Colorado Department of Game and Fish, Economic Value of Hunting and Fishing to the People of the State of Colorado - 1959, Mimeographed Release, Denver, Colorado, 1962.

6/ Ibid

travel, entertainment and other miscellaneous items. 1/

If we apply the 1959 expenditure rates to the 1960 number of hunters in each category we arrive at an overall expenditure of $634,677. A significant part of this total is spent on travel to the area, purchase of equipment outside of the area and the like. It would seem reasonable, however, to assume that hunters coming to the area to hunt spend half of their total expenditure in the area. On the basis of this assumption, big game hunting contributed approximately $317,300 to the local economy.

Skiing

The mountainous portion of the study area has become known as the "Alps of America" but yet it remains virtually untouched by our growing national army of skiers. There are a few developments which cater to the local residents such as the 100 foot rope tow at Hesperus and an 800 foot tow at Durango. Somewhat larger ski developments in the immediate vicinity which do draw some non-local skiers include Ignacio, Pagosa Springs, South Fork on Wolf Creek Pass and Stoner in Dolores County.

Skiers as a class spend a good deal of money in pursuit of their sport. The average skier in Colorado spent $11.70 per day and $50.25 per trip during the 1956-1957 season. 2/ During the 1960 season, the average per trip stood at $100, reflecting in part the tremendous increase in out-of-state skiers drawn to Colorado.

All Other Outdoor Recreation

This catch-all category is primarily composed of expenditure by local residents. No data on local expenditures are available, so an estimate

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1/ Ibid

2/ L.J. Crampon and R.D. Lemon, Skiing in Colorado and New Mexico, University of Colorado, Boulder, Colorado, 1957.

for this segment becomes a mere guess. Relative to other recreational expenditures in the area, it was assumed that the local expenditures on outdoor recreational pursuits not specifically covered above amounted to approximately $650,000 in 1960.

The above estimate was computed as follows. First, it was assumed that 90 percent of the "all other" recreational category expenditures came from local residents. On the basis of a 1958 commercial survey of Durango, it was determined that the effective buying power of all Durango residents totaled approximately $13 million. 1/ In order to remain on the conservative side in our estimate, this amount was applied to our calculations for 1960. Next it was assumed that 5 percent of the effective buying income was spent on outdoor recreational activities; this amounts to $650,000. If we assume further, that Durango residents accounted for two-thirds of the local expenditures, we arrive at a total of $975,000. Let us say that approximately 60 percent of this total was spent on the "all other" recreational category, or approximately $585,000. Then if an additional $65,000 were added to account for the assumed 10 percent contributed by non-local residents, we arrive at an overall total of $650,000.

Possibilities for Future Development

The current $4 million recreational industry is a major segment of the local economy. Summer tourism accounts for over half of the total expenditures at the present time but other segments have been growing in recent years. All recreational segments have a tremendous potential for growth and if recent findings of the Outdoor Recreation Resources Review Commission are considered, there is every likelihood that the area's recreational resources will be expanded rapidly. 2/

1/ W.L. Heuser, A Commercial Survey of the Durango Area, Bureau of Business and Economic Research, Fort Lewis A & M College, Durango, Colorado, 1958.
2/ Outdoor Recreation Resources Review Commission, op cit. pp-4 - 5.

The Recreation Commission's report high-lights the following conclusion developed from their study: "Outdoor Recreation is a Major Leisure Time Activity and It is Growing in Importance. About 90 percent of all Americans participated in some form of outdoor recreation in the summer of 1960. In total, they participated in one activity or another on 4.4 billion separate occasions. It is anticipated that by 1976 the total will be 6.0 billion, and by the year 2000 it will be 12.4 billion--a threefold increase by the turn of the century." 1/ A summary of their projected demand for various kinds of summer recreational activities is shown in Figure 9. On the basis of its findings, the Commission has recommended that: "It shall be the national policy, through the conservation and wise use of resources, to preserve, develop, and make accessible to all American people such quantity and quality of outdoor recreation as will be necessary and desirable for individual enjoyment and to assure the physical, cultural and spiritual benefits of outdoor recreation. Implimentation of this policy will require the cooperative participation of all levels of government and private enterprise. 2/

There are indications of the need for rapid acceleration in the development of recreational resources and the suggestion that national policy will encourage, if not demand such efforts. There is reason to believe that in areas where natural scenic wonders are abundant such development will be a significant item in their future economy. The five major components of the local recreation industry are reexamined in this section in view of the future developmental possibilities of each.

The Tourist Trade

In order to evaluate this component, let us compare what the area

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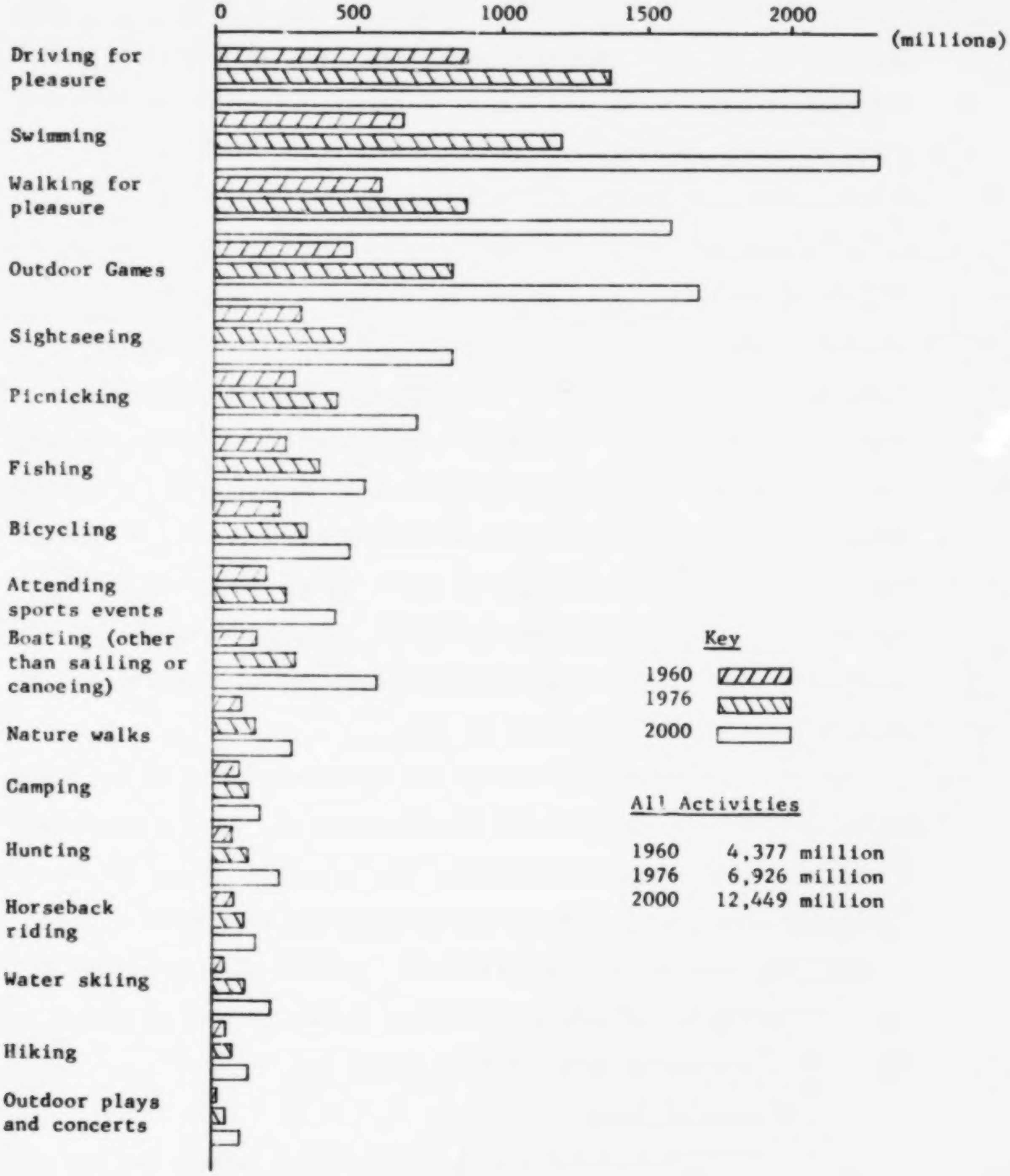
1/ Outdoor Recreation Resources Review Commission, op cit. pp 4-5.
2/ Ibid

Figure 9 - Number of Occasions of National Participation in Outdoor Summer Recreation, 1960 compared with Projections for 1976 and 2000.



Source: Outdoor Recreation Resources Review Commission, _Outdoor Recreation For America_, U. S. Government Printing Office, January 1962, page 46.

has to offer with what out-of-state tourists expect to find in Colorado. Their expectations, as reported in a University of Colorado survey, are summarized in Table 20. [1]

Ninety-four percent of those interviewed listed general sightseeing as their major aim, followed by 79 percent who wanted to combine this aim with picture taking. These goals were borne out as well by the recently completed Recreation Commission study. They found that driving and walking for pleasure, swimming and picnicking lead the list of outdoor activities with driving for pleasure the most popular of all.[2] Furthermore, they found that this is generally true regardless of income, education, age level or occupation.[3] The Four Corners region offers a variety of scenic surroundings for this activity seldom found elsewhere in an area of comparable size anywhere in the world. The local Chamber of Commerce in Durango has geared its promotion activities in this regard to the famous "Circle Trip," which involves a one-day drive through the surrounding countryside. During this drive, the points of interest visited can include the desert country of northwestern New Mexico, the famous Indian ruins at Mesa Verde, construction activities at Navajo Dam and other Federal reclamation projects, gold and silver diggings at Red Mountain, Silverton, and at numerous abandoned ghost towns, not to mention a collection of some of the highest mountains in Colorado. Among the more famous in the immediate area are Mt. Wilson and Sunlight Peak which rise to elevations of 14,246 and 14,053 feet respectively.

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[1] L. J. Crampon, The Tourist and Colorado, Bureau of Business Research, University of Colorado, Boulder, Colorado, 1956.
[2] Outdoor Recreation Resources Review Commission, op. cit. p. 6
[3] Ibid, p. 3.

Table 20. Percentage of Colorado Tourists Wanting to do Various Things While Visiting Colorado. 1/

Item Desired	Percentage
General sightseeing	94
Taking pictures	79
Taking it easy	74
Visiting historic spots	65
Picnicking	64
Shopping	52
Fishing--all types	49
Fishing-stream only	49
Camping	45
Hiking	43
Learning about Indians	41
Nature Study	40
Fishing in lakes only	37
Swimming	36
Horseback riding	32
Mountain climbing	29
Boating	29

1/ Seven other items desired but ranking below boating are not listed.

Source: L.J. Crampon, The Tourist and Colorado, op cit. p. 30.

The mountainous portions of the study area offer major attraction for at least nine additional tourist motivation classes: picnickers, campers, hikers, naturalists, equestrains and mountain climbers, and fishermen. Ready access for the pursuance of these sports is assurred by the fact that most of the mountainous area lies within the San Juan National Forest.

Sixty-five percent of the tourists visiting Colorado wish to "visit historic spots". Durango has long been a base of operations for a large share of this group. From this central location they can visit Mesa Verde, the Aztec ruins, Hovenweep National Park, the former site of old Fort Lewis A & M College (which in frontier days was an army post), the old mine diggings in San Juan County and several Indian reservations.

Almost one out of two Colorado tourists wants to do some fishing while in the state. Natural propagation of trout in the streams and lakes of the study area is far superior to that for the state as a whole but in addition, hatcheries at Durango and Dolores add significant numbers to the natural supply. For example, in 1953 the Durango hatchery released in excess of 790,000 trout in nearby waters. 1/ The combined effects of miles of excellent trout streams, high rates of natural propagation, and significant hatchery additions, have made the study area one of the leading trout fishing spots in the state.

Trout fishing in the area is not limited solely to streams. A number of excellent trout lakes, including Groundhog Reservoir, Vallecito Reservoir, Trout Lake and Gurely Lake, are also magnets for trout fishermen. These will soon be supplemented by reservoirs backing up behind Navajo Dam on the San Juan River and Lemmon Dam on the Florida River. In addition, warm water fish are found in abundance in the lakes and streams at lower elevations.

1/ W.L. Heuser, The Regional Economic Setting of Fort Lewis A & M College - The Economy of the Four Corners, Ft. Lewis A & M College, Durango, 1959, p. 33.

About four out of ten Colorado tourists visit the state in order to "learn about Indians". The Four Corners area has a virtual monopoly in this category. Located in the immediate vicinity of the study area are two Ute Indian Reservations, the Navajo Reservation and the former Indian settlements in Mesa Verde and Hovenweep National Park. Tourists frequently have an opportunity to observe Indians on the streets of Durango, Farmington, Cortez and Mancos.

Thirty-six percent of the visitors expressed a desire to go swimming and 26 percent indicated they would like to go boating while in the state. In many instances, the lower altitude lakes provide facilities for both of these activities. New reservoirs being built or in the planning stage will greatly expand the available surface acreage of water needed for these sports. In addition, there are some thermal springs in the area that can be developed in the future for swimming in naturally heated mineral water.

Without question, the Animas-LaPlata study area and the immediate outlying vicinity have recreational assets that appeal to a majority of Colorado tourists. While projecting a 60 percent increase in tourist expenditures in the state by 1965 relative to 1959, Professor W.L. Heuser estimated that the Four Corners area will enjoy an 80 percent increase, even under the assumption that no additional effort is expended on promotion. 1/

Professor Heuser based his 80 percent projection on the following factors:

1. Two highways, one national and the other international, are being developed and actively promoted in the area. One is the Navajo Trail, the shortest route between Chicago and Los Angeles. The other is the International Highway, Number 789, that links Alaska, Canada, the United States and Mexico. Both will pass through Durango and the latter will pass through

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1/ W.L. Heuser, An Analysis of the Feasibility of Enlarging Shopping Facilities in Durango, Colorado, op cit., pp 47-49.

Farmington as well.

2. Dude Ranch and resort type tourist facilities, not to mention the usual type of motel accomodations, are being developed in the study area at an accelerating rate.

3. Although the area's recreational assets are relatively unknown at the present time, this situation is being reversed. Friends telling each other was found to be one of the main reasons people choose an area to visit. 1/ As more home movies and snapshots of the study area are shown in living rooms across the nation, the tourist trade of the region is expected to grow proportionally.

4. There is evidence that a higher proportion of tourists visiting the study area return for other visits than is true for the state as a whole. Sixty-six percent of the tourists in the area interviewed in 1953, planned to return, as compared, for example, with 42 percent of the visitors in the Denver area. 2/

5. The Four Corners area of southwestern Colorado is showing a greater, continuous increase in the tourist trade relative to most other areas in the state and to the state as a whole. Between 1947 and 1957, the index of number of visitors grew from 88 to 200 in the state as a whole, from 98 to 176 in the Pikes Peak area, and 87 to 251 in southwestern Colorado.

6. The geographic location of the area is conducive to drawing tourists from a wide radius. It attracts people from the Far East, from Texas and New Mexico, and from California, whereas resort areas east of the

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1/ The Tourist and Colorado, op cit.
2/ Colorado Summer Tourist Survey, 1953, University of Colorado, p.52.

Continental Divide draw customers primarily only from the East and Southeast.

Others concerned with the tourist component of the recreation industry in the Four Corners area are even more optomistic about future expansion than Professor Heuser was. The Directors of Mesa Verde National Park, for instance, are expanding facilities in order to cope with an expected 100 percent increase in visitors during the 1957-1966 period. 1/ It becomes quite evident then that there is a good basis for a large increase in the tourist business in the study area within the next few decades.

The Narrow-guage Railroad

At the present time the narrow-guage railroad is the second largest income contributor to the recreation industry of the local area. Due to its limited passenger carrying capacity, however, its total contribution to the recreation industry is not likely to increase materially. 2/ Some consideration has been given to expanding the current summer sightseeing season to a year-round operation on the assumption that the winter portion would be supported primarily by skiers. This would be an expensive operation, however, due to the complexities of operating trains in this area during extreme winter weather conditions. The last winter train on the line operated in 1950 and when it was snowed in, it took a crew of men twelve days to shovel it out. Almost annually the officials of the Denver, Rio Grande and Western Railroad request approval in Washington to abandon operation of the line altogether but so far these requests have been denied. 3/ Even if such

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1/ Durango Herald News, Vol. VI, No. 236, October 8, 1957, p. 1.

2/ Although the number of passengers rose from 31,750 in 1958 to 36,000 in 1960, there is a physical limit to maximum carrying capacity.

3/ The latest ICC ruling, reported in the Denver News on May 3, 1962, will require the railroad to remain in operation and to expand its service to a year-round basis.

approval were eventually obtained, the train run would probably continue to operate for summer tourists because steps have been taken locally to purchase the line.

Big Game Hunting

This segment of the outdoor recreation industry is already an important part of the total recreational industry. With continuing population increase and with an increasingly greater share of this population engaging in hunting, it seems inevitable that the pressure on hunting facilities will continue. Furthermore, it is apparent that the combined efforts of the State Fish and Game Department and the Federal Government which manage large acreages of public access land will make significant gains in meeting the increased demand that will be generated for hunting in the study area. The recently completed report of the Outdoor Recreation Resources Review Commission which projects hunting activity to almost double by 2000 lends a feeling of urgency to getting this accomplished in the near future. The accelerating trend in the development of dude ranches or resorts is also based in part on their ability to find a market for their facilities among the big game hunters who annually migrate to the study area.

Skiing

What is the magnitude of the potential market for the area's skiing and other winter sport resources? There is every reason to believe that in the near future an extensive winter sports trade will be developed in the study area. Not only are the developers of ski centers involved, but the operators of summer tourist accomodations as well. A most ambitious undertaking in this field is currently under consideration by the Denver-Golden Mining Corporation. It would involve a multi-seasonal recreational development at Silverton with major emphasis on an ultra-modern ski center. Although ground has already been broken for the ski center, final development is pending the completion of an economic evaluation of this proposed business venture. 1/

There is no exact way to determine how many skiers could conceivably be attracted to the "American Alps" portion of the study area. One way of evaluating the prospect, however, is to obtain some idea of the size of the market. It has been estimated that there are some 50,000 people living in Arizona who ski, 50,000 in New Mexico, 325,000 in Utah and nearly the same number in Colorado. 2/ The study area is centrally located in respect to these four states and this combined number of 750,000 skiers therefore represents a large potential resident market. Whether or not they can be attracted to the area will be dependent upon development of adequate facilities. Beyond this group, there is the vast number of skiers who reside in California, Texas and throughout the East who would contribute at least some small part to the demand for skiing facilities in the area.

The study area has the physical attributes required for the development of another "Sun Valley". 3/ The mountainous terrain is ideal and certainly there is no lack of another basic requirement - snow. The average snowfall at Silverton, for example, is 160.8 inches and on Wolf Creek Pass east of Durango it exceeds 360 inches. A part of the facination of the study area, as far as potential skiers are concerned, is that it lies so near the areas of relatively mild winter climate in which so many of them live. In terms of skiing's present contribution to the recreation industry - about one-half of one percent of total expenditures - it has tremendous room for growth.

1/ Such a preliminary study has been prepared for the Denver-Golden Mining Corp. by Professor John Gilmore of the Denver Research Institute. The results of this study have not yet been released for public distribution.

2/ W.L. Heuser, The Regional Economic Setting of Fort Lewis A&M College, op cit.

3/ H.D. Meyer, W.L. Heuser, et al., Recreation in Colorado, University of Colorado, Boulder, Colorado, 1953, pp 31-34

Since the study area has the physical attributes required and a large potential market in the surrounding states, its possibilities for rapid expansion as a major ski center appear extremely bright.

All Other Outdoor Recreation

Expected future expansion in the miscellaneous components of the recreation industry will be linked closely with the expected population growth in the study area because most of these components are generated by local residents. Major emphasis on recreational activities locally will likely be on fishing, boating, skiing, mountain climbing and picnicking. A growing number of urban residents are acquiring rural properties for the pursuit of such activities in their leisure time.

Vast relatively undeveloped areas are available for such development within close proximity to Durango and Farmington. With the probable development of additional water storage reservoirs and associated recreational facilities, there is every reason to believe that large increases can be expected in the miscellaneous recreational pursuits in the area.

Summary

The outdoor recreation and tourist industries are important segments of the local economy. Although their growth rates in recent years have been more rapid than those experienced in Colorado as a whole, there still remains a large potential for additional expansion. It appears likely, as well, that such expansion will occur. First, there is a tremendous expected increase in demand for recreational outlets on a national basis. Second, a number of Federal water development projects are under construction or in the planning stage and the immediate area adjacent to these reservoirs will likely be developed as recreational property. 1/ Third, a number of large scale development companies in the private sector are considering the feasibility of providing additional recreational facilities in the area. Finally, a significant increase in demand for recreational facilities can be expected as a result of large population increases in the local and surrounding areas.

It is estimated that some 60 percent of present outdoor recreation is water oriented, and with the future development of additional water storage structures, this percentage will most surely increase. 2/ The Recreation Commission emphasized in its report to the President and Congress that water is a focal point of outdoor recreation. The report states in part:. "Most people seeking outdoor recreation want water-- to sit by, to swim and to fish in, to ski across, to dive under and to run boats over. Swimming is now one of the most popular outdoor activities and is likely to be the most popular by the turn of the century. Boating and fishing are among the top 10 activities. Camping, picnicking and hiking, also high on the list, are more attractive near water sites". 3/

Adequate water resources in a pleasing geographic location, such as the study area possesses, are not enough however, to foster recreational development. Many other things are needed including access to recreation sites, development capital and certainly suitable water quality. In regard to

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1/ The Outdoor Recreation Resources Review Commission recommended that in the implimentation of a positive attitude toward recreation in national policy, a number of roles should be vested in the Federal Government. Two of these roles would have a major impact on the development of water resources in the area. These are: 1) Government responsibility in the preservation of scenic areas, natural wonders, primitative areas and historical sites; and 2) The management of Federal lands for the broadest possible recreation benefit consistent with other essential uses. (See Commission Report, op cit, p. 6)

2/ Public Roads, Vol. 92, No. 8, August 1961, p. 10.

3/ Outdoor Recreation Resources Review Commission, op cit. p. 4.

management needs for recreation development, the Recreation Commission had this to say about water quality considerations: "The first is clearing up pollution....As a sanitation measure alone, the abatement of pollution is a necessity; inherently, it is also one of the best means of increasing outdoor recreation opportunities". 1/

The water oriented segments, and as noted above these are a major portion of the total industry, have a direct bearing on the separable benefits for water development structures, particularly those associated with water quality management. Since a number of Federal water storage structures are planned or underway in the area, their impact on the local economy will be of significant magnitude. The report of the Recreation Commission comments on economic benefits attributable to recreation as follows: "Although the chief reason for providing outdoor recreation is the broad social and individual benefits it produces, it also brings about desirable economic effects. Its provision enhances community values by creating a better place to live and increasing land values. It is big business as the millions and millions of people seeking the outdoors generate an estimated $20 billion a year market for goods and services. 2/

Income generated by the local recreation industry, therefore, has an impact on both the national and local economy. Only a relatively small share of the recreation-generated income is retained as profit by those engaged primarily in servicing this industry. Most of the generated income is respent in the form of meeting operating costs, payrolls, and the like. These transfer payments in turn find their way to ranchers, manufacturers, retailers, wholesalers and other businessmen in the economy. This, coupled with the fact

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1/ Ibid, p. 87
2/ Outdoor Recreation Resources Review Commission, Op cit. p.4.

that most recreation-generated expenditures are "new money" makes the outdoor recreation and tourist industries major components of the overall economy of the study area.

The study area has available the physical resources for providing the recreation experiences that most people visiting the area wish to engage in. Steps are being taken to expand the facilities for enjoying these attributes and knowledge of this fact is spreading as more people visit the area each year and as more state, regional and local interest groups step up their promotional activities. It appears relatively certain that recreation can easily become one of the mainstays of the local economy during the next few decades.

The Mineral Industry - Mining and Primary Processing

The Animas-LaPlata study area has a long and famous history of mineral production. Its early fame centered around Silverton where Charles Baker and his party made the first mineral discoveries in 1860. Mining has been a significant sector of the local economy ever since. To date, the western San Juan Mountain area of Colorado has produced minerals valued in excess of $137 million and a major portion of this was produced in the northern portion of the study area. 1/

Early prospectors were hampered by Indian trouble and not until a treaty was signed with the Ute tribe in 1873 was the area officially opened for permanent settlement. The Silverton area developed rapidly during the next two decades. A large mining industry flourished there until the late thirties when depressed metal prices and high wages forced a consolidation of properties and adoption of mechanized mining methods. As a result, the number of operating mines was reduced considerably but these continue to operate at a stable production level.

Interest in future development possibilities remains and a number of the major mining concerns are currently proceeding with long-range development programs which involve large investments. Since 1950, primary interest in mining in the study area has shifted from Silverton to the vicinity of Durango as a result of major oil and gas developments in southwestern New Mexico and adjacent areas. The present tendency for mineral interests in the study area is to: 1) Consolidate holdings for large-scale operation; 2) Improve exploration and mining practices; 3) Modernize metallurgical plants for

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1/ U.S. Department of Interior, Bureau of Reclamation, Feasbility Report: Animas-LaPlata Project, op cit.

treatment of large tonnages; and 4) Conduct research for extracting all valuable mineral deposits in their holdings.

Three major groups of minerals are found in significant quantities in the study area: mineral fuels, metals, and non-metals. Each have additional development possibilities. The major concentrations of mineral deposits in San Juan and LaPlata Counties in Colorado are listed in Table 21 and shown in map form in Figure 10. The number of operating mineral extraction units are listed in Table 22.

Present Economic Significance

The mineral industry produced a total value of product in excess of 12.6 million dollars during 1960 with approximately 55 percent of the total accounted for by the uranium processing mill at Durango.[1] Mineral activity other than uranium processing accounted for about 5.7 million dollars during 1960, which amounted to a 16 percent increase over the previous year (Table 23). A general rise in mining activities has been in effect since 1956 when total production stood at approximately $945,000.

Most of the increased economic activity of the industry has been due to rapid expansion in oil and gas production. The total value added by the mineral industry as a whole was estimated to be about 8.5 million in 1960 or 67.4 percent of the total value of production. These are only approximations, however, because exact production and value data were not available. In computing these estimates, state values reported in 1958 and 1959 were applied to 1960 production figures available on a county basis.

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[1] Estimates prepared by the authors. It is believed that these tend to be conservative since similar estimates prepared by others range from six million to 12.3 million for the uranium processing industry alone.

Table 21. Mineral Resources Known to Occur in the Animas-LaPlata Study Area.[1/]

Type of Mineral Deposit	Major Location
	LaPlata County, Colorado
Barite - - - - - - - -	Occurs as Gangue mineral in Chicago Basin at head of Needle Creek; undeveloped.
Clays - - - - - - - -	Numerous deposits of brick and fire clay throughout area.
Copper - - - - - - - -	Some past production in LaPlata Area; occurrence in the Chicago Basin.
Dolomite - - - - - - -	Small deposits throughout the county; undeveloped.
Fluorspar - - - - - -	Small pieces in gangue in county; undeveloped.
Fluorite - - - - - - -	Occurrence in Chicago Basin; undeveloped.
Gold - - - - - - - -	Past production in LaPlata, Chicago Basin, and along the Animas River. Small production at present.
Granite - - - - - - -	Small past production near Durango for local use.
Lead - - - - - - - -	Current production in LaPlata area.
Limestone - - - - - -	Past production near Durango.
Manganese - - - - - -	Occurrence in Chicago Basin; undeveloped.
Platinum - - - - - - -	Occurrences in LaPlata District; undeveloped.
Pumice and Pumicite - - - - - -	Past production northwest of Animas City; deposit east of Durango and occurrence in LaPlata area.
Pyrite - - - - - - - -	Occurrence in LaPlata area; undeveloped.
Sand and Gravel - -	Presently being produced. Sand deposits 26 miles south of Bayfield, 1 mile north of Durango, 1/2 mi. south of Trimble Springs; gravel deposits 4 1/2 mi. south of Durango; sand and gravel deposits 9 mi. north of Durango
Silver - - - - - - - -	Past and present production in LaPlata and Chicago Basin.
Tellurium - - - - - -	Occurrences in LaPlata District as tellurides; undeveloped
Uranium - - - - - - -	Some production in county on limited basis.

Table 21 - Continued

LaPlata County (continued)

Coal - - - - - - - - - -	Bituminous coal in southern half of county; subbituminous coal along southern edge of county.
Petroleum, crude natural gas - - - - -	Red Mesa field in southwest part of county; many smaller fields scattered throughout southern third of county.

San Juan County, Colorado

Arsenic- - - - - - - -	Occurs on Anvil Mountain near Silverton
Barite - - - - - - - -	Common/in Gangue mineral in county
Bismuth - - - - - - -	Occurs in Poughkeepsie District
Copper - - - - - - - -	Production at Silverton, Eureka, Poughkeepsie, Bear Creek, and Ice Lake Basin
Dolomite - - - - - - -	Small deposits in county
Flourspur - - - - - -	Gangue mineral in Dakota mine near Silverton
Garnet - - - - - - - -	Occurs in old limestone quarry just south of Silverton
Gems - - - - - - - -	Past production of Rhodonite at Sunnyside mine
Gold - - - - - - - -	Production at Silverton, Eureka, Poughkeepsie, Bear Creek, and Ice Lake Basin
Granite - - - - - - -	Small past production near Silverton
Graphite - - - - - - -	Large low-grade deposit between Cascade and Mineral creeks, 5 miles south of Ophir
Iceland Spar - - - - -	Occurrence reported in Silverton area
Lead - - - - - - - -	Production reported at Silverton, Eureka, Poughkeepsie, and Ice Lake Basin
Limestone - - - - - -	Past production 1 1/2 miles south of Silverton
Manganese - - - - - -	Occurrences near Silverton and Eureka
Potash - - - - - - - -	Occurence on Red Mountain
Pyrite - - - - - - - -	Past production in Silverton area, occurs throughout the county

Table 21 - Continued

San Juan County (continued)

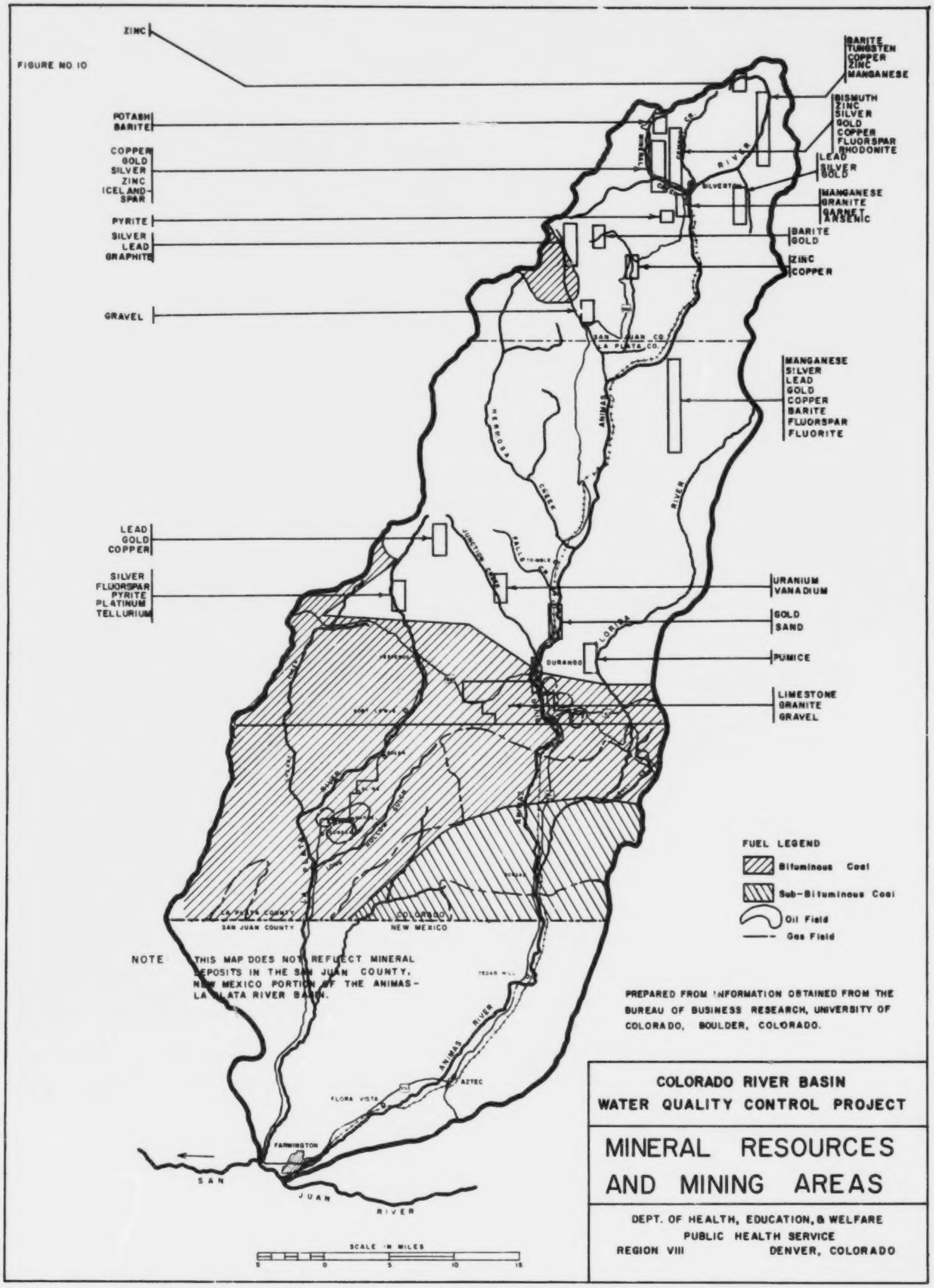
Sand and Gravel - - -	Past production, gravel on Cascade Creek 30 miles north of Durango
Silver - - - - - - - - -	Production at Silverton, Eureka, Poughkeepsie, Bear Creek and Ice Lake Basin
Tellurium - - - - - -	Tellurides in Bear Creek area
Tungsten - - - - - - -	Past production in Cement Creek region, also occurs on Sultan Mountain
Uranium, Vanadium - -	Occurrence in Georgia Gulch
Zinc - - - - - - - - -	Recent production reported. Past production in Eureka, Poughkeepsie, and Ice Lake Basin
Coal - - - - - - - - -	Small bituminous deposit near Grizzly Peak south of Ophir

Note: The LaPlata District contains over 60 mineral species but few are identified by name. A mineralized area exists on Mt. Runlett, about 20 miles northeast of Bayfield but type is not identified.

Source: Bureau of Business Research, University of Colorado, Local Area Statistics Series, "LaPlata County" and "San Juan County", prepared for the Resources and Community Development Division of the Colorado Department of Employment, 1962.

1/ Data limited to San Juan and LaPlata Counties, Colorado

FIGURE NO 10


ZINC
POTASH
BARITE
COPPER
GOLD
SILVER
ZINC
ICELAND-SPAR
PYRITE
SILVER
LEAD
GRAPHITE
GRAVEL
LEAD
GOLD
COPPER
SILVER
FLUORSPAR
PYRITE
PLATINUM
TELLURIUM
BARITE
TUNGSTEN
COPPER
ZINC
MANGANESE
BISMUTH
ZINC
SILVER
GOLD
COPPER
FLUORSPAR
RHODONITE
LEAD
SILVER
GOLD
MANGANESE
GRANITE
GARNET
ARSENIC
BARITE
GOLD
ZINC
COPPER
MANGANESE
SILVER
LEAD
GOLD
COPPER
BARITE
FLUORSPAR
FLUORITE
URANIUM
VANADIUM
GOLD
SAND
PUMICE
LIMESTONE
GRANITE
GRAVEL
RIVER
SILVERTON
SAN JUAN CO.
LA PLATA CO.
ANIMAS
HERMOSA
CREEK
JUNCTION
FALLS
CR.
RIVER
FLORIDA
DURANGO
LA PLATA COUNTY
SAN JUAN COUNTY
COLORADO
NEW MEXICO
CEDAR HILL
ANIMAS
RIVER
AZTEC
FLORA VISTA
FARMINGTON
SAN
JUAN
RIVER
FUEL LEGEND
▨ Bituminous Coal
▨ Sub-Bituminous Coal
Oil Field
Gas Field
SCALE IN MILES
5
0
5
10
15

NOTE: THIS MAP DOES NOT REFLECT MINERAL DEPOSITS IN THE SAN JUAN COUNTY, NEW MEXICO PORTION OF THE ANIMAS-LA PLATA RIVER BASIN.

PREPARED FROM INFORMATION OBTAINED FROM THE BUREAU OF BUSINESS RESEARCH, UNIVERSITY OF COLORADO, BOULDER, COLORADO.

COLORADO RIVER BASIN
WATER QUALITY CONTROL PROJECT

MINERAL RESOURCES AND MINING AREAS

DEPT. OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION VIII DENVER, COLORADO

Table 22 Number of Mineral Extraction Units in the Animas-LaPlata Study Area, 1960. 1/

Type	Number of Wells or Mines		
	LaPlata Co.	San Juan Co.	Total
Mineral Fuels			
Coal	13	None	13
Oil and gas	267	None	267
Metallic			
Gold, silver	2	1	3
Gold, silver, lead, zinc and copper - combined production	1	12	13
Base metals	1	9	10
Lead, zinc and copper	1	2	3
Gold, silver, lead	1	1	2
Quarries for non-metallic	NA	None	-

Source: Bureau of Business Research, University of Colorado, Local Area Statistics Series, "LaPlata County" and "San Juan County", Prepared for the Resources and Community Development Division of the Colorado Department of Employment, Boulder, Colorado, 1962.

1/ Data limited to San Juan and LaPlata Counties, Colorado.

Table 23 Production and Value Summary of the Mineral Industry in the Animas-LaPlata Study Area 1/, 1959 - 1960

Type of Mineral	1959			1960		
	Production	Total Value	Value Added 2/	Production	Total Value	Value Added 2/
Mineral Fuels						
Coal	28,015 tons	$ 129,200	NA	32,999 tons	$ 137,600	$ 114,200
Petroleum	20,300 bbls	59,600	NA	21,000 bbls	60,900	51,800
Natural Gas 3/	27,694,000 MCF	4,670,400	NA	28,682,000 MCF	4,814,100	3,848,200
Sub-totals	- -	4,859,200	NA	- -	5,012,600	4,014,200
Metals						
Gold	310 oz	10,900	NA	NA	79,900	NA 4/
Silver	7,303 oz	6,600	NA	NA	100,700	NA 4/
Copper	23 tons	14,100	NA	NA	227,200	NA 4/
Lead	145 tons	33,400	NA	NA	185,400	NA 4/
Zinc	110 tons	25,400	NA	NA	37,200	NA 4/
Uranium 5/	NA	6,500,000	NA	NA	6,900,000	4,140,000
Sub-totals	- -	6,590,400	NA	- -	7,530,400	4,448,000
Non-Metals						
Sand and Gravel	103,000 tons	43,300	NA	NA	58,800	47,600
Stone and other	1,019 tons	5,300		2,800	11,200	7,800
Sub-totals	- -	48,600	NA	- -	70,000	55,400
OVERALL TOTALS	- -	11,498,200	NA	- -	12,613,000	8,517,600

Sources: Compiled from a number of data sources including: Colorado Yearbook, 1956-1958; Mineral Yearbook, 1959; Minerals Yearbook, 1960; The Mineral Industry in Colorado; Census of Mineral Industries, 1958; Local Area Statistics, "LaPlata County" and "San Juan County"; Report of the Colorado State Bureau of Mines, 1960; and data collected locally by interview.

1/ Data limited to San Juan and LaPlata Counties, Colorado.

2/ Value added figures were estimated by using the respective state mineral commodity figures as a percentage of respective state figures for value of shipments and receipts.

3/ Includes one refining plant.

4/ Separate figures not available, the total for the five listed was reported to be $308,800 .

5/ Consists entirely of uranium processing; value figures based on average figures available for the industry on a state-wide basis.

Minerals Fuels

Coal production has remained relatively constant at approximately 33,000 tons during recent years and annually adds about $138,000 of product to the mineral industry. From a production value standpoint, natural gas is presently more important than petroleum in the area; production of natural gas in 1960 was valued at approximately 4.8 million compared to only $60,900 for petroleum. No major expansion has occurred in either segment in recent years. In 1960, 267 wells were in production. The combined value of mineral fuels accounted for 39.7 percent of the value of total mineral production in the area in 1960 and for 47 percent of total value added.

Metals

Metal mining at present is but a ghost of its former status but still adds a significant amount to the local economy. The major metals produced included gold, silver, copper, lead and zinc. Three uranium mines were in production in 1959 but no production was reported in 1960. Available 1959 figures indicate the following amounts of metals produced in the study area: gold: 310 ounces; silver: 7,303 ounces; copper: 23 tons; lead: 145 tons; and zinc: 110 tons (Table 23). 1/ Total value of metal mining production rose from $90,400 in 1959 to $630,400 in 1960, largely as a result of significant increases in silver, copper, and lead production. Value of metal extraction and primary processing accounted for 59.5 percent of the total value of the mineral industry in 1960.

Uranium ore processing by the Vanadium Corporation plant at Durango accounted for the largest increment in the metal category of the industry.

1/ U.S. Department of Interior, Bureau of Mines, Minerals Yearbook, 1959, Vol. III, Area Reports, U.S. Government Printing Office, Washington, D. C., 1960, p. 214.

Estimates of tons of ore processed daily range from 430 to 500. 1/ 2/ The plant is currently operating on a round-the-clock basis, seven days a week.

Non-Metals

Production of non-metals, limited primarily to sand and gravel, is only a minor segment of the local mineral industry at the present time. Value of sand and gravel production in 1960 was reported to be only $58,800; quarrying of stone added another $11,200. Combined, this total value of production amounted to less than one percent of the total mineral production in the study area during 1960.

Evaluation of Present Status and Future Development Possibilities

This evaluation will be carried out under three major headings: mineral fuels, metals and non-metals. Separate discussion of the major components in each category are also provided.

Mineral Fuels

Mineral fuels produced in the study area include coal, petroleum and natural gas. Almost all of the activity in this category is confined to LaPlata County, Colorado and San Juan County, New Mexico. This discussion is limited, however, to the Colorado portion. Coal mining has been of major importance in the past but since 1950, major interest in the mineral fuels have been centered on petroleum and natural gas.

1/ F.E. McGinley, "An Introduction to Uranium Ore Processing", *Guidebook to the Geology of the Paradox Basin*, Ninth Annual Field Conference, of the Intermountain Association of Petroleum Geologists, Utah Geological and Mineralogical Survey, University of Utah, Salt Lake City, Utah, 1958, p.217.

2/ E.C. Tsivoglou, et al, "Estimating Human Radiation Exposure on the Animas River", *Journal of American Water Works Association*, Vol. 52, No. 10, October 1960, p. 1271.

Coal

Coal horizons are known to occur in the Dakota sandstone and in the Mesa Verde and Fruitland formations throughout the San Juan Basin. 1/

Some idea of the economic significance of future coal mining developments in the area can be obtained by evaluating the estimated reserves. The United States Geological Survey has estimated the total recoverable reserves in the Durango area at 1,852,590,000 short tons. 2/ Even if coal were worth only $1.00 per ton, we would have a reserve of almost 2 billion dollars of developable resources. It is quite likely that the estimates of coal reserves, like those for oil, are conservative, but even on the basis of our current knowledge, it is comforting to find a virtually untouched vast store of this resource in the study area.

Future developments of the coal industry will in all probability be linked with chemical derivatives from coal. Reduction plants that would transform the hydro-carbons of coal to motor fuel, for example, would undoubtedly be located in the study area since it is far cheaper to transport liquids by pipeline than to ship raw coal to existing chemical installations on the West Coast. The same is true regarding future uses of coal as a raw material in other chemical industries.

Oil and Gas

Expansion of the petroleum industry in the general Four Corners area in recent years has attracted worldwide attention. Farmington, New Mexico is in the center of this mining activity but Durango has become the administrative center for the industry. As such, the resulting oil and gas income to Durango

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1/ C.M. Bauer and J.B. Reeside, Coal in the Middle and Eastern Parts of San Juan County, New Mexico, Geological Survey Bulletin 716-G, "Contributions to Economic Geology", Part II, U.S. Government Printing Office, Washington, D.C., 1920, pp. 155-237.

2/ M. H. Howes, op cit.

tends to be of a more steady nature than is usually associated with unstable "boom towns" located in the midst of oil exploration and development activities in other parts of the country.

Interest in the Four Corners area as a possible oil production center can be traced to 1891 when an unsuccessful well was drilled near Green River, Utah. 1/ The first successful well was brought into production near Mexican Hat, Utah in 1908 and within three years 26 additional rigs were in operation in the immediate vicinity. Development activity was accelerated during the 1920's, primarily through the efforts of the Midwest Refining Corporation. Activity continued intermittently until the late 1940's when a mushrooming development was initiated with the discovery of Dove Creek, Boundary Butte, Desert Creek, Aneth and several smaller fields.

Since the 1940's, oil and gas developments in the area have been of a continuing nature. In 1957, the Durango Herald News published the following excerpts from an article on this subject by the Business Editor of the Rocky Mountain News:

> The Four Corners area continues to hold the spotlight as the most active area on the Rocky Mountain Region's oil map with a total of 448 wells listed in the current reports of regional activity.
>
> Durango, Cortez, and Farmington can expect a good healthy growth from oil development the next 15 to 20 years. Many residents do not seem to realize the magnitude of what is happening to them. It will take 5 years to bring some of these fields to peak production and another 5 years to taper off. In the meantime, exploration will continue steadily to find new reserves. 2/

1/ W.L. Heuser, An Analysis of the Economic Potential of the Cortez, Colorado, Area, op cit. p. 1.
2/ Durango Herald News, July 25, 1957.

Mr. Edgar B. Heylmun, Consulting Geologist from Salt Lake City, Utah recently provided the following analysis of development possibilities:

> "There are a number of laccolithic-type intrusions in the Colorado Plateau province of Arizona, Utah, and Colorado. The most prominent of these features are the Abajo, La Sal, and Henry Mountains in Utah, the Ute, LaPlata, and San Miguel Mountains in Colorado; and the Carrizo Mountains in Arizona.....Despite the fact that most of the intrusions have been accompanied by varying degrees of uplift, there have been only a few wells drilled for oil and gas in their vicinities. Some of the wells, however, have met with marked success. The El Paso Natural Gas-Standard No. 1 Bita Peak well in section 19, T. 41 N; R. 31 E. Apache County, Arizona was completed for 20,878 MCF of gas per day, on an anticline just four miles from an igneous dike associated with the Carrizo mountain intrusions. One of the gas wells on McElmo Dome, section 25, T. 36 N.; R. 18 W., Montezuma County, Colorado, is only three miles from porphyry outcrops at the north end of the Ute Mountain intrusions.....
> .....Since there is no existing surface structure to indicate why the intrusions occurred where they did, it is possible that their emplacement was controlled by pre-Pennsylvanian structure. If this is true, then there could be excellent prospects for oil or gas.....In addition to the pre-Pennsylvanian possibilities for oil or gas, the Pennsylvanian itself offers excellent objectives, as present production in the Four Corners area will testify." 1/

1/ E. B. Heylmun, "Oil and Gas Possibilities Around the Laccolithic Type Intrusions in the Colorado Plateau", Guidebook to the Geology of the Paradox Basin, pp. 238-240.

Experts in the petroleum industry are certainly not in complete agreement regarding the long term economic significance of the oil industry in the local economy. On the one hand, Core Laboratories Inc., for example (in a report to the Utah Oil and Gas Conservation Commission) has held that the maximum life of the Aneth Field in Utah would be only 15 years and the same will apply to other oil fields in the area. This point of view was further substantiated recently by the Oil and Gas Journal which reported that the Cha Cha and Totah fields in northwestern New Mexico are expected to have a shorter life than normal. 1/ They report further that the Pan American Petroleum Corporation is already taking steps for secondary recovery. "Water flooding will begin this winter on a few Pan Am leases in the Navajo Reservation". 2/

Other experts, however, believe that major oil development and production could continue as long as 50 to 75 years in the area. 3/ The tremendous investment in the area by a number of major oil companies certainly seems to indicate that their view of the future production potential of the region is a positive one. New fields in this area are brought into production quickly and usually reach a stage of maturity the first year, whereas most fields take a decade.

The oil resources of the study area and the adjacent production fields in the San Juan Basin have significance not only as a source of current local income, but also as a power resource for future industrial development, as an export item in inter-state trade, and as a future raw material for the chemical industry. Gas from the area is now sold as far away as the Portland-Seattle area via the Pacific Northwest Gas Pipeline and oil is marketed in

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1/ Staff report, Oil and Gas Journal, Vol. 59, No. 51, Dec. 18, 1961, pp. 133-134.
2/ Ibid
3/ James Tatum, geologist, quoted in the Durango Herald News, Oct. 4, 1958.

Los Angeles via the 635 mile Four Corners Pipeline. 1/

The latest development in distribution facilities was an 8 inch gas pipeline from the Ignacio field in LaPlata County, Colorado to Del Norte, Colorado, 90 miles to the east. This line was completed in only 74 working days during the fall of 1961 even though it had to traverse some of the most rugged terrain in the Rocky Mountain Region. 2/ The gathering system for this pipeline serves 42 local wells. The line was constructed by the Western Slope Gas Company, a subsidiary of the Public Service Company of Colorado. Gas-sales contracts have been signed with Menlo Corporation and Pan American Petroleum Corporation. Planned extensions to the pipeline during 1962 will terminate at Climax, Colorado. Some idea of daily production from the wells served can be deduced from the fact that "the Tiffany compressor station is designed to operate at 200-psi suction pressure and 1,000-psi discharge at 25 M.M.c.f. per day". 3/

It is recorded history that with every major well brought into production in the area, the estimates of oil and gas reserves are revised upwards. In 1950, experts employed by the El Paso Natural Gas Company, testifying before the Federal Power Commission, estimated that the whole Four Corners area had five trillion cubic feet in gas reserves. By 1953, other geologists were estimating that the Blanco-Mesa Verde area, which is but a small part of the Four Corners area, contained reserves of at least 15 trillion cubic feet. 4/ By 1957, an estimate by the Colorado Department of Natural Resources listed gas reserves for the Four Corners area at 31 trillion cubic feet and oil reserves at one billion barrels. 5/ Since exploration is still actively being carried on, it is highly probable that subsequent estimates will even be higher.

1/ The Mines Magazine, Vol. XLVI, No. 11, November, 1956, pp. 59-60.

2/ W. Bleadley, "2-Mile-High San Luis Valley Project Goes on Stream-On Schedule", The Oil and Gas Journal, Vol. 60, No. 2, Jan. 8, 1962, pp. 87-89.

3/ Ibid.

4/ The Rocky Mountain Oil Reporter, Vol. 14, No. 1, January 1957, pp. 12-20.

5/ Durango Herald News, Vol. VI, No. 213, Sept. 10, 1957.

The economic value of natural gas and crude oil reserves in the Four Corners region reaches astronomical proportions, even if we consider 31 trillion cubic feet of natural gas and one billion barrels of crude oil as top estimates. At an assumed price of 12 cents per 1000 cubic feet, the gas reserve is worth approximately 3.7 billion dollars. With oil at three dollars a barrel, this reserve would be worth 3 billion dollars. Mr. Kenneth Chasteen, Managing Editor of Oil News, recently made the following observation about the area in an article in the Oil and Gas Journal: "This 100 square miles of beautifully rugged Four Corners terrain may well rank as the richest 64,000 acres in the U.S." 1/ Even if we assume that perhaps only five percent of this region's 6.7 billion dollar oil and gas reserves lie in the study area, we still arrive at a value of 335 million dollars.

An indirect but nonetheless significant impact of the oil and gas industry on the local economy results from land lease and royalty incomes. These income sources are of particular importance to the local economy because they represent a direct source of purchasing power to local land owners. Leases have traded in the area with overriding royalties ranging from 2 1/2 to 5 percent with the latter figure most often obtained. 2/ Royalties are now a major source of income for Indian tribes in the area. "Royalty on fee, State, Federal and Indian leases in the basin have been one-eighth until a short time ago when the Navajos, Utes and Piutes raised the royalty rate on new leases to one-sixth." 3/ 4/

1/ Kenneth Chasteen, "Drillers Keep Probing Lisbon Valley's 'Rich Acres' in Paradox Basin", Oil and Gas Journal, Vol. 60, No. 7, February 12, 1962, p. 166.

2/ G.D. Fehr and J.R. Williams, "Oil and Gas Leasing in the Paradox Basin, Guidebook to the Geology of the Paradox Basin, op cit., pp 241-244.

3/ Ibid

4/ "Revenues received from individual allotted Indian lands are paid to the owners thereof. Revenues from Tribal lands are deposited in the Treasury of the United States to the credit of the tribe. These deposits draw interest of 4 percent until withdrawn by the tribe on an approved budget". Statement of the U.S. Bureau of Indian Affairs as reported in the Guidebook to the Geology of the Paradox Basin, op cit., p. 244.

Oil land lease rates far exceed the going rate for land sales which existed in the area before the oil and gas boom arrived. The Phillips Corp., for example, made a top bid of $726,000 for a lease on 2,900 acres in 1956. 1/ Some idea of the rapidly rising market in leases is provided in the following summary:

> "Prices paid land owners for fee lands started out at 50 cents and $1.00 per acre in 1946, and ranged from $2.00 per acre to $15.00 per acre until a year or two ago when some fee lands were leased at higher figures and one tract near the Wheeler Trading Post went for $1,000 per acre to the land owner.
>
> "Recent prices paid for assembled state, federal and fee blocks in areas ranging from 25 to 90 miles north and west of the Aneth oil field have varied between $12.50 and $30.00 per acre with 5 percent overriding royalty. Prices closer to Aneth have ranged even higher.
>
> "Indian lands have been leased for as little as a dollar or two up to the all-time record high Indian bid of $4,308 per acre with 1/6 royalty paid by the Carter Oil Company in December, 1957". 2/

It appears, overall, that the oil and gas industry will continue as a stimulating influence on the economy of the study area. Some indication of the magnitude of this impact may be drawn from an examination of the growth experience resulting from a similar development in west Texas. Midland, the local population center, became the administrative office for this development, just as Durango has become the center for the Four Corners area. In a period of only five years, Midland grew from approximately 30,000 population to over 50,000. Nearby Odessa, which performed the functions of service and supply for the industry, more than doubled its population within a decade and became a young metropolis of 60,000 people. Within the Four Corners area, the cities of Durango and Farmington correspond to Midland and Odessa of the west Texas development. Already, Farmington has shown signs of similar growth and Durango can be expected to follow the same pattern.

1/ Durango Herald News, Vol. VI, No. 217, September 15, 1957.
2/ G. D. Fehr and J. R. Williams, op. cit., p. 242.

Metals

Ore deposits in the study area are concentrated primarily in San Juan County (Figure 10). They can be conveniently classified into three categories: 1) Lodes; 2) Stocks or masses; and 3) Metasomatic replacements. [1] The lodes have produced the greatest number of productive mines. The second category, known locally as chimneys, have produced many of the high output mines in the Red Mountain district immediately to the north of the study area. The third category is relatively unimportant in this area, being limited to a few deposits occurring in limestone and rhyolite.

The San Juan Mountain portion of the study area was actively prospected during the 1870's and nearly every lode subsequently developed was discovered at that time. Not all the valuable minerals contained in them, however, were recognized when first discovered. A 1905 geology report gives the following account of a case in point:

> "Although the first mine worked in the district, the Little Giant, in Arastra Gulch, was a gold producer, for many years prospecting was practically restricted to a search for silver and lead ores. It was apparently owing to this adherence to an established routine that the Una and Gertrude claims, in Imogene Basin, worked twenty years ago for silver and lead, were subsequently abandoned, with no knowledge of the rich gold ore which lay close alongside the argentiferous streak, and which was thrown out as waste. Masses of this rich ore were discovered by Thomas F. Walsh on the Camp Bird claim, and subsequently on the dump of the old workings of the Una and Gertrude, and he purchased the latter in 1896. It is today one of the most productive (gold) mines......" [2]

Prior to the advent of railroad connections to the area, ores worth less than $100 a ton could seldom be handled profitably. The Silverton Branch of the Denver and Rio Grande narrow-gauge railroad was completed in July 1882 and many mines producing low grade ore were quickly developed.

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[1] F. G. Ransome, "Economic Geology of the Quadrangle", Geologic Atlas of the United States: Silverton Folio, Colorado, U.S. Geological Survey, Department of Interior, Washington, D.C., 1905, p. 26.

[2] Ibid.

Mining gradually diversified but total production remained at a high level until the slump of the late thirties. Mining continued at a low ebb during the '40's and 50's but in recent years, some recovery has been made with major emphasis now given to copper, lead and zinc production.

Gold

Although much of the present gold production is realized as a by-product to other mining activities, some mines producing only gold are still in operation. After a number of years of low level production, a major increase occurred in 1960. There is still considerable room for expansion in the gold mining segment with its future hinging primarily on a more favorable product price.

Recent developments in mining technology would allow an economical recovery of low grade ores in dumps left by early miners if a slightly more favorable gold price existed. As a general rule of thumb, the early miners discarded all gold ore worth less than $50 a ton and large quantities of these ores are present in the area. The future of gold mining in the study area is not limited solely to recovery of low grade ores and reprocessing of old mining dumps. There is a strong possibility that much gold ore remains undiscovered. A U.S. Geological Survey report discussed this possibility as follows:

> "In some places failure to find new ore can be traced to ill advised exploration methods arising from ignorance of the geologic conditions. It seems clear that favorable conditions for ore shoots are produced by a wide variety of geologic conditions, that many veins contain many ore shoots, separated by nearly barren stretches, and the same ore shoots do not crop out at the surface. The outlook for the discovery of new ore bodies along many of the known veins is therefore promising, provided the exploratory work is intelligently undertaken.
>
> "Not only many new shoots may be found in known deposits, but new deposits may be discovered. None of the really productive deposits were found until after 1900, and the new discoveries made since then have occurred at widely separated intervals. There is no apparent reason for believing that 1933..marked the end of the discovery period for new ore bodies..." 1/

1/ E.B. Eckel, et. al, Geology and Ore Deposits of the LaPlata District, Colorado, U.S. Department of Interior, Geological Survey, U.S. Government Printing Office, Washington, D.C., 1948.

In recent years several of the major gold mining corporations in the area have made substantial capital investments in the form of further exploration and increased mechanization. The immediate results are reflected in part in the large increase in production in 1960 over 1959 and a further increase during 1961. The LaPlata Gold Mining Corporation, for example, spent $150,000 recently to renovate the Old Bessie G Mine northwest of Durango. 1/ Most of this investment went into roads so that the mine would be accessible to trucks and heavy equipment. Eight tons of raw ore are now being produced every four hours. If a more favorable gold price developed in the near future, there is every reason to believe that a further expansion in gold mining would result in the area.

Silver and Lead

With few exceptions, the mines of the study area produced ores in which silver and lead are the predominent metals. In the early days of the local mining industry, silver was "king" but with the decline of silver prices in 1892, many high producing mines were closed. Although silver has had its ups and downs since then, it still remains one of the more important metals produced.

The United States is a net importer of silver and uses more in domestic industry than is mined in the country. There is likewise a good market for lead. It appears reasonable therefore that a combined silver and lead mining industry will remain in the study area. The dollar value of production of both these ores increased greatly from 1959 to 1960 and there are indications that further increases can be expected in the near future.

1/ Don Hough, "The New Life of the Bessie G", Empire Magazine, the Denver Post, April 22, 1962, p. 26.

Copper

Much of the copper produced in the area is recovered as a by-product of other mining operations, but certainly not all. In some cases, the reverse is true. The copper industry has been subsidized for some time by means of stockpiling and giving of contracts guaranteeing a minimum buying price in order to insure an adequate domestic supply for reasons of national security.

Copper production in the study area (and in the adjacent ore deposit sections of the Four Corners area as well) has been relatively minor. The geographic isolation of the area and the relatively low value per ton of most of its ore deposits account for this in part. Due to its large reserves and the rapid depletion of high grade deposits in other areas, however, there is a large future potential for the copper mining industry in the study area. Such an expansion has already gained momentum. The production of recoverable copper in short tons in the San Juan Mountain district of Colorado increased 91 percent from 1948 to 1953 while Michigan's Lake Superior region declined in production by 27 percent and southeastern Missouri's production decreased 60 percent. 1/ Production in San Juan County in 1954 was valued at $6,534; it rose to $14,100 in 1959 and to $227,200 in 1960.

Several major producing operations are making long term investments in the areaat the present time. It is especially significant that a subsidiary of Kennecott Copper Company filed 39 separate claims in LaPlata County in 1958. 2/ Such investments in production facilities, along with expansions in copper refining centers in nearby Arizona, assure that the local copper industry will continue to increase in importance.

1/ W.L. Heuser, An Analysis of the Feasibility of Enlarging Downtown Shopping Facilities in Durango, Colorado, op cit. pp. 23-24.
2/ Ibid. p. 25.

Zinc

Colorado ranks fifth in zinc producing states in the Nation. Contracts given by the Defense Minerals Exploration Administration to stimulate zinc production in Colorado are dominated by San Juan, San Miguel and Dolores Counties. In 1953, for example, contracts to producers in these three counties totaled $120,680 while the total for the other counties in the state was only $33,500. 1/

Much of the current zinc production is produced in conjunction with refining of other metals produced in the area. Many additional zinc producing deposits exist, however, but development is dependent upon an improvement in world price structure and foreign trade relationships compared to cost of production. Either an increase in domestic and/or world demand and increased price, or new advancements in refining techniques, would quickly bring additional local producers into operation. In the short term, the importance of zinc mining in the area has decreased slightly; production in 1956 was valued at $56,700 while in 1959 and 1960 it was $27,400 and $37,200 respectively. In the long run, however, a major expansion in the local zinc industry can be expected.

Uranium

Radio-active ore production has been an extremely unstable segment of the mineral industry. Some idea of its turbulent history can be obtained from the following summary:

> "Mining of uranium-vanadium deposits began in the Rock Creek area of Montrose County, Colorado, in 1881. The mineral carnotite was first described and named from a specimen collected from this area in 1898. From 1904 until 1914, mining for radium was widespread throughout the belt from Slick Rock to Gateway. .... Mining for vanadium became

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1/ U.S. Department of Interior, Bureau of Mines, Minerals Yearbook, 1953, op cit., p. 1257.

> important in 1936 and continued until 1944 when government ore purchasing programs were terminated. The district was again dormant until 1948 when the Atomic Energy Commission established an ore-buying schedule for uranium. Further stimulation came in 1951 when the AEC raised the base price for uranium and established an initial production bonus and other benefits. From 1948 to January 1, 1958, 680 mines have shipped 3,408,300 tons of uranium-vanadium ore with an average value of $29.50 per ton. During the last half of 1957 production averaged 55,311 tons per month from 403 mines. Two processing mills are completely dependent. (The Vanadium Corporation mill at Durango is one of the partially dependent mills)." 1/

Little if any uranium ore is mined in the study area at the present time. Only one mine, with a production of 77 pounds and valued at $362, was in operation in 1958. In 1959, three mines were reported operating but no production figures are available and in 1960 none of them were operating. These mines may have ceased operation for a number of reasons. Direct mining costs for the industry as a whole are about $9.00 to $12.00 a ton, exclusive of exploration, amortization and depreciation, and for small mines this cost is considerably higher. 2/ Even if high operating costs did not force their closing, the fact that the three large companies who control about 50 percent of the overall uranium industry are currently buying up small mine leasing rights may have been a factor.

Known ore reserves of significant amounts are known to occur in the study area and may be brought into production at a future date if the economics of the industry warrants it. While recently the Atomic Energy Commission has slowed down its automatic purchase policies for new reserves, the short-run future of the industry appears favorable. The current policy calls for the purchase of reserves previously developed through 1966 and hence production and payrolls are expected to remain constant through 1966. 3/

1/ H.B. Wood and M/A. Lekas, "Uranium Deposits of the Uravan Mineral Belt," Guidebook to the Geology of the Paradox Basin, op cit. p. 208.
2/ Ibid, p. 215.
3/ Henry Hough, Editor of the Rocky Mountain Oil Reporter, quoted in the Durango Herald News, December 10, 1958, p. 1.

The uranium industry is extremely important to the study area because of the location of the Vanadium Corporation of America mill at Durango. Ore is shipped in from mines throughout the Four Corners area in order to keep it operating on a round-the-clock basis. It is easily the largest single employer in the study area. The plant's contract balance from the Atomic Energy Commission will expire during 1962 but current indications are that the contract will be renewed through 1966 and that the plant will remain in full-time operation.

Experts in the uranium industry are expecting something in the nature of a boom shortly after 1966 when civilian industrial demands are expected to exceed military requirements. This point of view was expressed by Gordon Weller, Executive Vice-President of the Uranium Institute of America in his analysis of the future of the uranium industry. 1/ If his evaluation is correct, the study area reserves and the processing mill at Durango will probably share in this anticipated expansion.

The Non-Metals

Historically, the non-metals have been an insignificant part of the local mining industry. Production has been limited primarily to meeting local needs for sand, gravel and building stone. Some increase in activity in these products can be expected as Durango and other towns increase in size but this will still be minor relative to the expected increases in the mineral fuels and metals. A short-run expansion can also be expected in response to planned Inter-state highway construction.

The search for petroleum in the Four Corners area also resulted in the discovery of potash deposits in considerable quantities. The recently

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1/ Gordon Weller, quoted in the Denver Post, September 8, 1958, p. 1.

announced development plan for a large potash plant by the Superior Oil Company of California in LaPlata County, Utah, has led to speculation as to whether or not such a development can occur in the study area. 1/ Present geological knowledge is insufficient to determine whether deposits in paying quantities underlie the area. "The deposits may or may not extend into the Colorado portion of the basin". 2/ It is conceivable, however, that as oil exploration continues in the area significant quantities of potash and perhaps other desirable minerals, may be discovered.

Summary

The mineral industry has always been a significant segment of the local economy. During its early years, activity was concentrated primarily in silver and gold production. Since 1950, oil and gas have been the major segments of the industry. Following a slump during the 1930-1950 period, the production of metals is again on the increase, notably copper and lead. Coal remains a depressed sector of the industry. Production of non-metals has never expanded beyond local needs for sand, gravel and building stone.

Mining ranks first in importance in the local economy at the present time and in the long run, there is every reason to expect an absolute increase of major proportions in its total economic value. It may drop to third or even fourth place in relative importance, however, as other sectors of the local economy increase. This is likely, particularly in the recreation oriented and manufacturing sectors.

Varying growth rates may be expected for the various components within the mineral industry. The uranium ore processing sector has a very unstable

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1/ R.W. Bernick, "Potash Picture Gets New Push in Utah", Salt Lake City Tribune, Salt Lake City, Utah, January 12, 1962.
2/ R.J. Hite and W.C. Gere, "Potash Deposits in the Paradox Basin", Guidebook to the Geology of the Paradox Basin, op cit. p. 221.

future in comparison to the other sectors but there are some long run prospects for further development nonetheless. The oil and gas components will probably continue to grow at a stable rate. Gold, silver and the other major metals may experience short-run declines because they are so overly dependent upon world-wide price conditions. Coal appears to have a long-run favorable outlook but it may well be a number of years before demands increase enough to make large expansions in coal mining economically feasible.

Manufacturing

Manufacturing activity in the study area at the present time is somewhat limited, relative to the role of this industry in the urban economy of the East. Such industries are extremely important in a well-balanced economy, however, and must be further developed if future economic growth of the study area is to be achieved.

The number of manufacturing establishments, including metal processing mills and gas refining plants, increased from 27 in 1954 to 52 in 1961. 1/ The census definition of manufacturing, "the mechanical or chemical transformation of inorganic or organic substances into new products," is used in the following analysis, with the exception that metal processing mills and natural gas refining plants were excluded. 2/ (These were included in the previous section dealing with mineral industries.) Within this revised definition of manufacturing, we had 40 establishments in 1960 and 45 in 1961 (Table 24). 3/ The 1960 data are used in the following analysis.

1/ Bureau of Business Research, University of Colorado, Local Area Statistics: La Plata County, San Juan County, op cit.
2/ U.S. Department of Commerce, Bureau of Census, 1954 Census of Manufacturing. Bul. MC-105, U.S. Government Printing Office, 1955, p. 111.
3/ Bureau of Business Research, University of Colorado, 1961 Directory of Colorado Manufacturers, Boulder, Colorado, 1961.

Over half of the total number of manufacturing establishments in the study area were engaged in either food processing or production of lumber and wood products. The remainder were distributed among textiles, fabricated metals and machinery, printing and publishing, and the miscellaneous categories. Only six establishments employed more than 20 people in 1960 and just one of these,a lumber and wood products plant, reported more than 100 employees. (Table 25)

The manufacturing industry of the study area is presently concentrated in Durango and vicinity and is oriented to the existing transportation network. (Figure 11) Thirty-two of the 40 establishments reported in 1960 had a Durango mailing address and five of the remaining eight were located in nearby Bayfield. 1/ Manufacturing activity in Silverton is limited to a single printing and publishing plant.

Present Economic Significance

Table 26 provides data on a number of economic parameters for the local manufacturing industry in 1960 compared with 1954 and 1958. In 1960, manufacturing ranked second among the local resource oriented industries in terms of total value of products sold. Its reported sales of approximately $4.3 million outranked recreation and agriculture (recreation $4,095,000 and agriculture sales, $4,063,000) by a very narrow margin, but fell considerably short of the $12,617,000 figure for minerals. 2/ Value added by manufacturing has risen at about the same rate as total value of sales. It rose from approximately $1.7 million in 1954 to $2.5 million in 1958 and to $2.7 million in 1960.

There was a significant increase in the labor force employed in manufacturing between 1954 and 1958. Total employment has remained relatively constant

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1/ Bayfield is actually located outside of the drainage area of the Animas LaPlata watersheds.

2/ It is doubtful that manufacturing retained the second place position in 1961. Preliminary tabulations provided by the Colorado State Department of Revenue listed total sales in 1961 at $2,655,000 which is even lower than the industry's 1954 total.

Table 24. Number of Manufacturing Establishments,[1] Animas-LaPlata Study Area,[2] 1960 and 1961.

Type of Manufacturing Activity	1960 Number	1961 Number
Food and Kindred Products	10	13
Lumber and Wood Products	13	13
Textiles and Apparel	1	2
Fabricated Metals and Machinery	2	2
Printing and Publishing	9	7
All Other	5	8
Totals	40	45

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[1] Excludes primary metal processing mills and natural gas refining plants.

[2] Data limited to San Juan and La Plata Counties, Colorado.

Sources: 1960 Directory of Manufacturers for the Colorado River Basin, op. cit., and Local Area Statistics: La Plata County and San Juan County, op. cit.

Table 25. List of Manufacturers in the Animas-La Plata Area 1/, by Name, Location and Number of Employees, 1960. 2/

Industry Classification	Name of Company	Location	No. of Employees
Food and Kindred Products	Basin Packing Company	Rt. 2, Durango	0-19
	Basin Neon, Ltd.	3060 Main, Durango	0-19
	Clover-Rich Ice Cream Co.	Box 558, Durango	20-99
	Coca-Cola Bottling Co.	7th St., Durango	0-19
	Durango Ice & Produce Co.	Durango	0-19
	Farmers Supply Co.	210 W. 9th, Durango	0-19
	Graden Flour Mill	West of R.R., Durango	20-99
	Jackson-David Bottling Co.	640 Main, Durango	0-19
	Sheppard Baking Co.	Box 947, Durango	20-99
	Tanner Flour Mill	Bayfield	0-19
Lumber and Wood Products	Lee Bartholomew Mill	Box 61, Bayfield	0-19
	Cecil Hasstedt Mill	Bayfield	0-19
	Sower Brothers Mill	Bayfield	0-19
	Mehl Tafoya Mill	Bayfield	0-19
	Atkins Mill	Rt. 1, Durango	0-19
	C. W. Barker Mill	Rt. 1, Durango	0-19
	Don Dafoe Co.	Box 720, Durango	0-19
	V. A. Grubbs Co.	Durango	0-19
	Las Animas Wood Products	S. Durango	0-19
	McReynolds Furniture and Upholstering Co.	Box 136, Durango	0-19
	J. Stanley Weidman, Inc.	Durango	100-249
	McCable Bros. Co.	Rt. 1, Mancos	0-19
	Orveille Miller Mill	Rt. 1, Durango	0-19
Textiles and Apparel	Barnes-Sharon-Konoa Furs	Animas Valley, Durango	0-19

Table 25. Continued

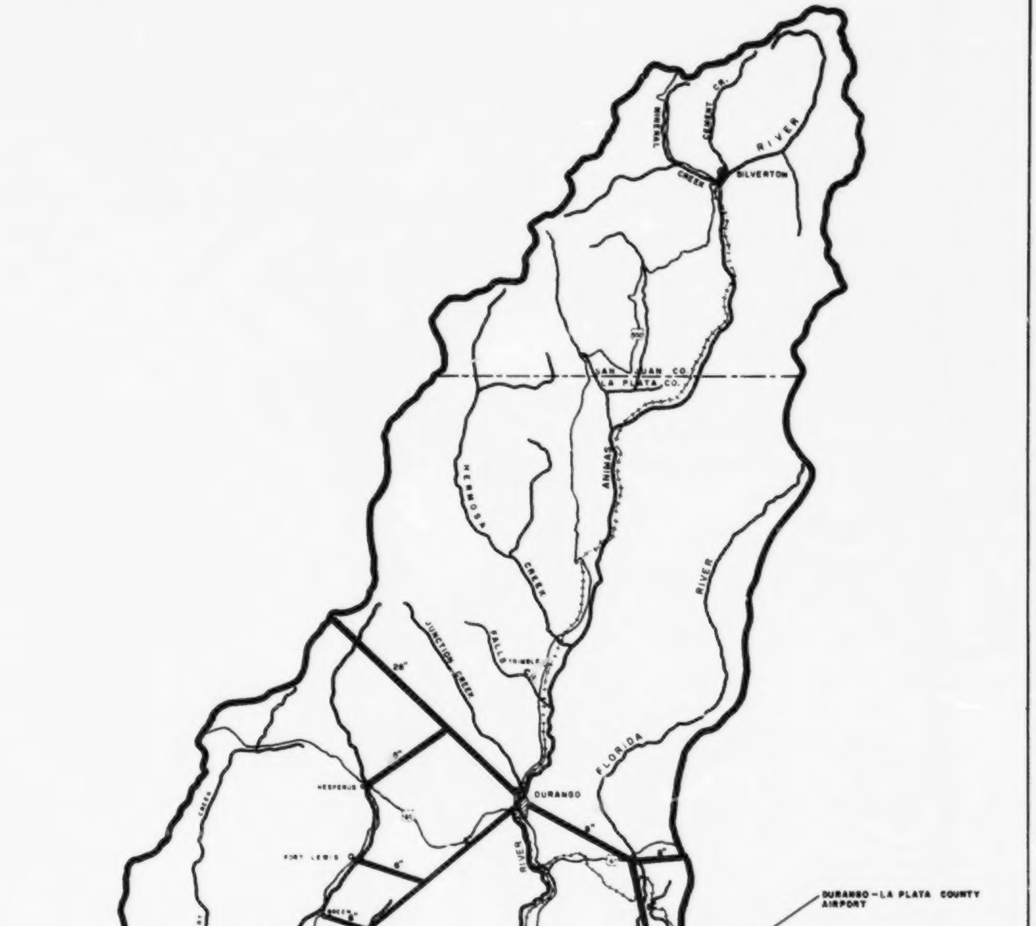
Industry Classification	Name of Company	Location	No. of Employees
Fabricated Metals and Machinery	Oliger Sheet Metals	1474 Main, Durango	0-19
	Telluride Iron Works	400 Main, Durango	20-99
Printing and Publishing	Basin Star	Durango	0-19
	Durango-Cortez Herald	Durango	0-19
	Durango Sign & Neon Co.	6th & R.R., Durango	0-19
	Four Corners Sign Co.	6th St., Durango	0-19
	Herald News	1022 Main, Durango	20-99
	La Plata Printing Co.	1478 Main, Durango	0-19
	Tristate Printing Co.	124 E. 15th, Durango	0-19
	Ignacio Chieftain	Ignacio	0-19
	Silverton Standard	Silverton	0-19
All Others	Durango Mattress Co.	140 E. 8th, Durango	0-19
	Eagle Block Co.	Rt. 2, Durango	0-19
	Mickleson Jewelry	Animas Valley, Durango	0-19
	Wilson Red-E Mix Concrete Co.	2020 N. Boyer, Durango	0-19
	Taylor-Raymond Jewelry Co.	839 Main, Durango	0-19

1/ Data limited to San Juan and La Plata Counties, Colorado.

2/ The following establishments were included in the Mineral Industry Section and are therefore not listed in this table: El Paso Natural Gas Co., Vanadium Corp. of America Mill, Ignacio Gasoline Plant, Red Mountain Mine and Mill, and Shenandoah Limited Company.

Source: 1960 Directory of Manufacturers for the Colorado River Basin, Colorado River Basin Water Quality Control Project, Basic Data Report No. 2, U.S. Dept. of HEW, Public Health Service, Region VII, Denver, Colorado, January 1962, pp. 36-40.

FIGURE NO. 11


MINERAL CREEK
CEMENT CR.
RIVER
SILVERTON
SAN JUAN CO.
LA PLATA CO.
HERMOSA CREEK
ANIMAS
RIVER
JUNCTION CREEK
FALLS
TRIMBLE
26"
6"
DURANGO
FLORIDA
HESPERUS
FORT LEWIS
DURANGO-LA PLATA COUNTY AIRPORT
RIVER
LA PLATA
CREEK
CHERRY
KLINE
GULCH
HOLLOW
LONG
REDMESA
ANIMAS
RIVER
6"
OIL & GAS LINE. NUMBER INDICATES SIZE OF LINE.
HIGHWAYS
RAILROADS
LA PLATA COUNTY
SAN JUAN COUNTY
COLORADO
NEW MEXICO
CEDAR HILL
ANIMAS RIVER
AZTEC
2-16"
FLORA VISTA
16"
FARMINGTON
SAN
JUAN
RIVER
SCALE IN MILES
5
0
5
10
15

COLORADO RIVER BASIN
WATER QUALITY CONTROL PROJECT

TRANSPORTATION

DEPT. OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION VIII DENVER, COLORADO

Table 26. Economic Parameters of the Manufacturing Industry, Animas-LaPlata Study Area,[1] 1960, Compared with 1954 and 1958.

Parameter	1954	1958	1960
No. of Establishments	27	29	40
Average No. of All Employees	302	350	352
Total Wages	$684,000	$1,027,000	$1,236,000
Total Value of Products Sold	3,300,000	4,000,000	4,329,000
Value Added by Manufacturing	1,704,000	2,465,000	2,730,000

Sources: U. S. Department of Commerce, Bureau of Census, Census of Manufacturers, 1954 and 1958; University of Colorado, Bureau of Business Research, Local Area Statistics: San Juan County and LaPlata County; Unpublished data provided by the Colorado State Department of Revenue; and information obtained by local interviews.

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[1] Data limited to San Juan and LaPlata Counties, Colorado.

at 350 however, since 1958. Total wages paid by the manufacturing industries amounted to $1,236,000 in 1960 compared with $1,027,000 in 1958 and $684,000 in 1954. The food and kindred products group employs the greatest percentage of the manufacturing labor force in the area. This group is followed closely by lumber-wood products, and the printing-publishing group. The 1960 distribution of the local manufacturing labor force by major manufacturing subclasses compared with Colorado in 1960, is shown in Table 27.

Future Development Possibilities

Does the regional economy of the study area have the necessary elements to sustain a future growth in manufacturing? To answer this question, one can gain some insight by comparing what various firms require before they will locate in an area with what the study area has to offer. A study by Crampon and DeGood provides some useful observations in this regard. 1/

The status of the local market is a primary factor in plant location for many types of manufacturing. This is a plus factor for the study area because its market potential has been increasing rapidly as evidenced by available data on retail sales. Of course, some manufacturers are dependent on local market demands other than those generated by individual consumers. For example, there has been an increasing tendency in the Four Corners area to produce locally much of the oil and gas dehydrating equipment used there. 2/ Probable area growth was a factor listed by almost 50 percent of the respondents in the Crampon and DeGood industrial location survey. 3/ Again conditions in the study area look favorable because as the foregoing analysis of its resource utilization indicates, the area will probably continue to expand at a rapid rate.

1/ L.J. Crampon and P.W. DeGood, Industrial Location Survey, University of Colorado, Boulder, Colorado, 1957, p. 4.
2/ Bureau of Business Research, University of New Mexico, New Mexico Business, Vol. 10, 1957, p. 16, Albuquerque, New Mexico.
3/ Crampon and DeGood, op. cit., p. 16.

Table 27. Labor Force Employed in Manufacturing, by Major Categories, Animas-LaPlata Study Area, Compared with Colorado, 1960.

Manufacturing Sub-Classes	Study Area 1/		Colorado	
	Number	Percent	Number	Percent
Food and Kindred Products	111	31.5	17,595	17.8
Lumber and Wood Products	99	28.1	3,092	3.1
Printing and Publishing	77	21.9	10,008	10.1
Chemicals	4	1.1	3,264	3.3
Fabricated Metals	4	1.2	18,744	19.0
Non-electrical Machinery	14	4.0	6,896	7.0
All Other	43	12.2	39,288	39.7
Totals	352	100.0	98,887	100.0

1/ Data limited to San Juan and La Plata Counties, Colorado.

Source: U.S. Department of Commerce, Bureau of Census, Census of Population: 1960: Colorado, Final Report, U. S. Government Printing Office, Washington, D. C. 1961.

The potential supply of labor is also of major concern in locating a new manufacturing plant. According to the industrial location survey cited above, the availability of needed labor influenced 47 percent of the firms who have located plants in the Four Corners area in recent years. Also, according to the study, "The larger plants are not necessarily seeking out the larger cities. Instead, they apparently, today, prefer the medium size city or the city between 5,000 and 29,999 population." [1] This, too, speaks well for the probable future industrial growth of the study area inasmuch as both Durango and Farmington fall within this size range.

Labor cost is still a major factor in plant location for the manufacturing industry as a whole. ".....A plant may locate in a town such as Fort Collins rather than Denver because the labor costs tend to be lower in the smaller cities". [2] Labor costs do not necessarily concern all manufacturing industries, however. There is a growing tendency in the Southwestern United States (and this will certainly apply to the study area in the future) for the rapid expansion of new footloose "growth" industries. This group of manufacturers has a special set of requirements and cheap labor is not one of them. [3] The basic requirements of these industries are explained in the following quote from John Fisher which appeared in the September 1961 issue of Harper's magazine:

> "The exciting new growth industries--electronics, for instance, aren't interested in cheap labor. They need highly skilled men and are willing to pay. Neither are they much interested in low taxes, because low taxes mean poor schools.
>
> "The major growth industries of the postwar era differ in six important characteristics from the old fashioned industries such as steel, textiles and automobiles.

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[1] Ibid, p. 25.
[2] Ibid, p. 25.
[3] John Fischer, "Guest Editorial-Economic Development," Reprinted with permission from Harper's magazine, Wyoming Progress Reports, Vol. 1, No. 10, January 1962, p. 3.

1. They mostly produce items of small size but of great value.
2. They do not use huge tonnages of raw material and fuel.
3. Consequently, they can locate practically anywhere they please.
4. Their plants usually operate without noise, smoke or smell.
5. They aren't greatly concerned about unions.
6. Their one critical requirement is brainpower--they must at all costs attract (and hold) really first-rate scientists, technicians and executives.

"It is interesting to note the places where such industries have chosen to locate. ....(Such) areas did offer two powerful attractions:

1. A pleasant environment to live in.
2. Great universities.

"....Since the key men in a space-age factory also are likely to value these things, it is only sensible to locate the plant where they are already available.

"Certain states (or areas) seem to be out of the running because of a lack of an enticing environment and inability to create a great university...." 1/ 2/

When viewed from a positive point of view, the study area definitely appears to be in the running for attracting its share of "footloose" industries. The region as a whole has an attractive climate, characterized by low humidity and a large percentage of possible days of sunshine, and in addition has an above average supply of scenic attractions. The area also has the nucleus of a potentially great university. Ft. Lewis A and M, starting from scratch on a new campus in Durango only a few years ago, is already in the process of expanding into a four year, degree-granting, institution. Like most A and M schools, it will attract technically skilled personnel important to the mining and agricultural development of the immediate area.

1/ Ibid.
2/ An editorial in the Denver Post in November 1961 also expounded on this theme. It quoted Governor Anderson of Minnesota as follows: "What people are now looking for are good universities, technical facilities, trained man-power, cultural attractions, and first-class civic surroundings".

The availability of raw materials is of course a leading consideration in the location of many types of manufacturing plants, including to a degree some of the footloose industries evaluated above. The study area lies in the center of a vast region containing virtually uncounted reserves of many industrially important raw materials--many of which are already in short supply in older manufacturing centers in the nation. The study area, for example, has large energy resources of all kinds, forest and agricultural resources, potential for development of additional industrial water, and both metallic and non-metallic minerals. Its mineral resources include copper, fluorspar, gem stones, limestone, manganese, pyrite, rhodonite, uranium and zinc, to name only a few.

The range of products that could be manufactured from resources available locally stagger the imagination. Chemical plants, for example, could produce any multitude of products from such basic raw materials as coal, oil, and natural gas which are in abundant supply locally. Fluorspar deposits could provide the raw material for production of refrigerants, as a catalyst for high octane gasoline, for production of a fluxing agent used in glass manufacturing, and in the manufacturing of hydrofluoric acid. The presently undeveloped deposits of rhodonite in San Juan County, Colorado, might potentially be used in the manufacture of manganese and local deposits of pyrite can afford the basis for the manufacture of sulphuric acid now so commonly used in industrial processes. The list of production possibilities available in the area could be continued almost indefinitely.

Other factors affecting plant location merit brief mention. These include community appearance and facilities, land for plant location and expansion, transportation facilities, industrial water sources, industrial fuels, possible zoning constraints, and the like. No future development constraints in regard to these items are evident in the area with the possible exception of transportation for potential manufacturing firms dealing in low value, bulky items. The geographic isolation of the area held back its industrial development but modern transportation development is rapidly removing this barrier. Air transportation facilities are being expanded locally and with the completion of modern highway systems through the area, motor trucks can provide 10 hour service to most areas within a 350-500 mile radius of Durango. Although the Navajo Trail is still under construction, 15 trucking lines have already requested use permits and many of these firms plan to locate permanent servicing facilities in Durango. 1/

Even without consideration of the special resource-based potential of the study area, one could safely predict some industrial growth for the area simply on the basis of such growth as a part of expected further industrial development of the Southwestern United States. A national survey of manufacturing executives, reported in Dun's Review and Modern Industry, predicted that industry will continue to move to the south, the southwest, and the Pacific Coast. 2/ The following reasons for this continued shift were cited:

> "...good productive labor supply, lower building costs, and better business climate. But the most important reason is simply the development of new, untended markets in these areas". 3/

Comments prepared by the Western Business Consultants, Inc., in an evaluation of manufacturing growth prospects in Maricopa County, Arizona, may apply to the Animas-LaPlata study area as well. They state in part:

1/ Information obtained by interview from Mr. R.B. Spearman, Chairman, Durango City Planning Commission, on July 25, 1961.
2/ "Planning Tomorrow's Plants", Dun's Review and Modern Industry, March 1959.
3/ Ibid, p. 111.

> "The effect of this anticipated growth of the Pacific Southwest upon the industrial future of Maricopa County should be felt in at least two ways. It will mean that the Phoenix area has long since lost the disadvantage of remoteness from markets. Instead, it will be on the periphery of what will probably be one of the largest consumer and industrial markets in the United States..."[1]

Summary

Manufacturing is not yet highly developed in the study area when compared with the role of this industry in the urban economy of the east. Yet, within the last few years it increased in importance to a level comparable to agriculture and recreation. Long range growth of the industry is likely to be encouraged by availability of adequate power, raw materials, potential water supplies, a growing regional market, and perhaps most important, a desirable environment for living.

Such economic expansion in the area need not necessarily detract from recreational development possibilities as so often occurred in eastern industrial expansion. The late Professor Heuser commented in this regard as follows:

> "All of this (anticipated industrial growth) is not to predict or even advocate that the San Juan is going to or should become another Pittsburgh or Birmingham. While the region as a whole can certainly absorb an increase in population of several million without losing its charm through overcrowding, there is no necessity for this growth to take place in the form that will yield congested metropolitan areas....The present level of technology in transportation makes possible dispersed locations both for manufacturing plants and workers' homes. Optimum size communities..., well located from the standpoint of economic efficiency, would be reminiscent of some of the neotechnic-age communities developed in recent years in Sweden, or Switzerland. Both countries have integrated manufacturing with their other industries of agriculture, tourism, etc. without spoiling the picturesque quality of their regions." [2]

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[1] Western Business Consultants, Inc., Economic Analysis and Projection for Phoenix and Maricopa County, Reprinted by Maricopa Planning and Zoning Department, Phoenix, Arizona, November 1959, p. 68.

[2] W.L. Heuser, An Analysis of the Feasibility of Enlarging Downtown Shopping Facilities, Durango, Colorado, op. cit., p. 64.

Commercial and Government Economic Activity

The resource-oriented industries evaluated above have a major impact on the size of the commercial and government sectors of the local economy. Included in these secondary or non-resource oriented sectors are retail trades, wholesale trades, services, transportation and storage, utilities, rentals and finance, contract construction, and various financial activities of local, state and Federal Governments. These will be discussed briefly in this section in order to indicate their relative magnitude and their dependence upon the basic income generating sectors of the local economy.

There were approximately 791 commercial firms conducting operations in the study area during 1960 (Table 28). These firms had a combined gross business of approximately $69,027,000 and provided employment for an average of 1,112 owner-operators and 2,956 hired workers. The total payroll for the commercial sectors during 1960 was approximately $10,384,000 or 52.6 percent of the total payroll for the study area.

Commercial activities are not carried on strictly within the type of firm identification indicated in Table 28. Retail firms, for example, commonly carry on a limited amount of servicing and some wholesale business. Even some of the non-commercial industries such as mining and manufacturing carry on various types of commercial activities. Total commercial activity, including that portion carried on by non-commercial operations, amounted to approximately $70,624,000. Retail sales amounting to $25,001,000, was by far the most important commercial activity. A summary of total commercial activity in the study area in 1960 is shown in Table 29.

Retail Trades

There were 309 active commercial retailers operating in the study area in 1960 (Table 30). These firms carried on $27,309,000 gross business.

Table 28. Summary of Economic Activity by Type of Commercial Firm, Animas-LaPlata Study Area, 1960. 1/

Type of Firm	No. of Firms	No. of Owner-Operators	Hired Workers Number	Hired Workers Payroll	Gross Business
Retailers	309	321	950	2,850,000	27,309,000
Wholesalers	48	51	155	960,000	15,064,000
General Service	210	436	842	1,186,000	6,842,000
Finance, Insurance & Real Estate	35	60	153	704,000	4,143,000
Utilities 2/	14	9	324	1,571,000	6,951,000
Transportation & Storage	25	35	374	2,361,000	4,745,000
Contract Construction	150	200	158	752,000	3,973,000
Totals	791	1,112	2,956	10,384,000	69,027,000

1/ Data limited to San Juan and LaPlata Counties, Colorado.
2/ Does not include 2 water companies operated by local governments.

Source: Compiled by the authors from Monthly Business Statistics, Colorado State Department of Revenue, Survey of Current Business, Office of Business Economics, Denver, Colorado, University of Colo., Local Area Statistics: San Juan and LaPlata Counties, op. cit., and U.S. Department of Commerce, Bureau of Census, 1958, Census of Business preprints, BC 58-SA6; BC 58-WA6; BC 58-RA6, U. S. Government Printing Office, Washington, D. C.

Table 29. Summary of Commercial Activities, by Type of Operation, Animas-LaPlata Study Area, 1960. 1/

Type of Firm	Type of Operation							Total Commercial Activity
	Retail	Wholesale	Service	Finance	Utility	Trans.	Constr.	
Retail	21,503,000	3,322,000	807,000				1,677,000	27,309,000
Wholesale	1,039,000	13,536,000	231,000			258,000		15,064,000
Service	924,000	883,000	5,035,000					6,842,000
Finance, Insurance, Real Estate				4,143,000				4,143,000
Utilities	449,000		70,000		6,432,000			6,951,000
Transportation and Storage	75,000		25,000			4,645,000		4,745,000
Contract Construction	242,000						3,731,000	3,973,000
Mining	100,000							100,000
Manufacturing	544,000	653,000						1,197,000
Government	125,000		175,000					300,000
Totals	25,001,000	18,394,000	6,343,000	4,143,000	6,432,000	4,903,000	5,408,000	70,624,000

1/ Data limited to San Juan and LaPlata Counties, Colorado.

Source: Estimates by the authors.

Table 30. Summary of Retail Activity, by Standard Industrial Classification, Animas-LaPlata Study Area, 1960. 1/

Standard Code No.	Type of Firm	No. of Firms	Total Sales	Percent of Total Sales
52	Building Material, Hardware and Farm Equipment	22	1,776,000	6.5
53	General Merchandise	34	4,044,000	14.8
54	Food	24	9,803,000	35.9
58	Eating & Drinking Establishments (Inc. Liquor Stores)	69		
55	Automotive & Service Stations	72	8,359,000	30.6
56	Apparel and Accessories	13	644,000	2.4
57	Furniture, Home Furnishings and Equipment	14	1,629,000	6.0
59	Miscellaneous	61	1,054,000	3.8
Total		309	27,309,000	100.0
Less Non-Retail Sales			5,806,000	
Total Retail Sales by Retailers 2/			21,503,000	

1/ Data limited to San Juan and LaPlata Counties, Colorado.
2/ Does not include $3,498,000 of retail sales by non-retail establishments. Total retail sales in the study area amounted to $25,001,000.

Source: U.S. Department of Commerce, Bureau of Census, 1958, Census of Business preprints, BC 58-RA6, U.S. Government Printing Office, Washington, D. C.

Approximately $21,503,000 of this amount falls within the retail category. The remainder was distributed among wholesaling, services, and contract construction. The retail payroll for hired workers amounted to $2,850,000. An average of 950 workers were engaged in retail trades during 1960.

Table 30 also provides a breakdown of the retail segment into eight major categories according to the Standard Industrial Classification Code. The automotive segment accounted for the largest proportion of sales with approximately $8,359,000. Next in importance were food stores, eating and drinking establishments, and general merchandise groups. These reflect the importance of the recreation industry to the local economy inasmuch as a high proportion of the sales of these categories were made to tourists and other travelers.

Since other firms outside of the retail category provide some retail trade, the total gross retail sales during 1960 were higher than the amount shown in Table 30. Other type of firms that had significant retail sales include the general service firms, wholesalers, manufacturers and the building contractors. An estimated $25,001,000 of total retail sales were made in the study area in 1960 if all retail activity is considered.

Wholesale Trades

Gross receipts accounted for by 48 wholesale firms in 1960 amounted to approximately $15,064,000. These firms employed an average of 155 hired workers with a total payroll of $960,000.

Wholesale activity followed the same general distribution pattern as retail sales activity. In addition to the $13,536,000 of wholesale sales by these firms, an estimated $4,858,000 of wholesale trade was carried out by non-wholesale firms for an overall wholesale figure of $18,394,000 in 1960.

Services

There were an estimated 210 general service firms in operation during 1960 with a combined gross sales figure of $6,842,000 (Table 28). The combined gross service sales of all firms amounted to approximately $6,343,000 in 1960.[1] A considerable portion of gross service sales, some 20 percent, was made by non-service type firms as indicated previously in Table 29.

Service firms employed an average of 842 hired workers during 1960. Combined payroll of these firms amounted to $1,186,000. The lodging business ranked high among components in the service sector, both in total sales and number of hired employees.

Rentals and Finance

Finance, insurance and real estate firms are included in this category. During 1960, 35 firms were reported in operation in the study area. Total gross income from fees, commissions, and the like amounted to an estimated $4,143,000. Combined payroll for this category amounted to $704,000. A check of employment trends and bank deposits for this industry in recent years indicates continuous growth from 1950 through 1958. A slight decline occurred from 1958 to 1960 but activity seems to have leveled off in 1961.

Utilities

Fourteen utility companies were engaged in supplying electricity, natural gas and communication services in the area during 1960. In addition, two water companies were operated by local municipal governments. The 14 privately operated firms employed an average of 324 hired workers and had a combined payroll of $1,571,000. These fourteen firms had gross sales amounting to an estimated $6,951,000. A list of utility firms in the study area and a summary of their operating capacity are included in Table 31.

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[1] Includes retail, wholesale and other non-service activities of these firms.

Table 31. Number of Utility Firms and Summary of Operating Capacities, Animas-LaPlata Study Area, 1960. 1/

Electric Power

Name of Firm	Western Colorado Power Company
Type of Operation	Rural
Area Served	Durango and LaPlata County portion to north & west of city, also San Juan County
Installed Generating Capacity	9,000 KW
Name of Firm	Colorado-Ute Electric Assn., Inc.
Type of Operation	Rural
Area Served	LaPlata County south of Durango
Installed Generating Capacity	Not available
Name of Firm	LaPlata Electric Assn., Inc.
Type of Operation	Rural
Area Served	LaPlata County east of Durango
Installed Generating Capacity	2,011 KW (Purchased from Colorado-Ute)
Name of Firm	Silverton Electric Light Company
Type of Operation	Private
Area Served	Silverton only
Installed Generating Capacity	Not available

Natural Gas

Name of Firm	Southern Union Gas
Source of Supply	Red Mesa Field near Farmington, N.M.
Reserve Available	20 or more years at present load
Name of Firm	El Paso Natural Gas
Source of Supply	Ignacio, Colorado
Reserve Available	37,700 MCF

Butane and Propane

List of Firms Serving the Area	Arrow Gas and Service Co., Farmington, N.M. Basin Petroleum Inc., Durango, Colorado Butane Power and Equip. Co., Durango, Colo. Durango Butane Co., Durango, Colo. Medford Oil Co., Durango, Colo. George Bingel, Silverton, Colorado

Continued

Table 31. Concluded.

Water

Name of Firm	City of Durango Water Dept.
Maximum Available	7,500,000 gal/day
Present Maximum Consumption	7,500,000 gal/day
Average Flow	3,400,000 gal/day
Storage Capacity	72,000,000 gallons
Name of Firm	Silverton Municipal Water Dept.
Maximum Available	Nearly unlimited, partial diversion from 3 streams available
Present Maximum Consumption	Unmetered
Average Flow	Unmetered
Storage Capacity	1,109,900 gallons

Telephone

Name of Firm	Mountain States Telephone & Telegraph Company
Type of Operation	Private
Area Served	All of San Juan and La Plata Counties except Marvel, Colorado
Name of Firm	Marvel Telephone Company
Type of Operation	Rural
Area Served	Marvel, Colorado

1/ Data limited to San Juan and La Plata Counties, Colorado.

Source: University of Colorado, Local Area Statistics: LaPlata County and San Juan County, op. cit.

Transportation and Storage

Transportation and storage facilities are of extreme importance to the study area due to its remote location in relation to adjacent centers of economic activity. There are five major types of commercial transportation facilities serving the area: railroad, truck, bus, airline and pipeline (Table 32).

Trucking facilities carry the bulk of the freight in and out of the area. During 1960, 19 separate truck lines were in operation. A major share of the heavy freight associated with oil and gas development is carried by the Denver and Rio Grande Western Railroad. Its freight tonnage increased from 277 tons in 1957 to 444 tons in 1959. [1]

Two major pipelines provide transportation for natural gas out of the area. The El Paso line, which connects with outlets on the west coast and Texas refineries, has been in operation a number of years. A new line, the Western Slope from Ignacio to Alamosa, Colorado has just recently been put into operation. Air service is provided by Frontier Airlines and Gregg Charger Service. Two bus lines provide passenger transportation.

Transportation firms supported an estimated 35 owner-operators and 374 hired employees during 1960. Payroll for the year was estimated to be approximately $2,361,000 and total receipts were approximately $4,745,000.

Contract Construction

There were an estimated 150 construction firms in operation during 1960 and they involved a labor force of 358 persons. Total payroll amounted to approximately $752,000. Gross business of the firms amounted to approximately $3,973,000. Over half of the value of contract construction within Durango was

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[1] Gene Wortsman, "I.C.C. Says Silverton Railroad Must be Kept Open All Year", Denver News, May 3, 1962.

Table 32. Number of Transportation Facilities, by Type of Carrier, Animas-LaPlata Study Area, 1960.

Type of Carrier	Area Served
Truck Lines	
1. Albright, Louis N.	local and intrastate
2. Baker, David	local and intrastate
3. Boyd E. Richner, Inc.	local and interstate
4. Burnett Construction Co.	local and intrastate
5. Cannonball, Inc.	local, intra-interstate
6. City Taxi, Inc.	local, Durango
7. Don Ward, Inc.	local and intrastate
8. Farmers Lumber and Supply Co.	local and interstate
9. Hodges, Willis L.	local, Silverton
10. Montezuma Truck Lines, Inc.	local and intrastate
11. Percell, Dayton E.	local, Durango
12. Pine River Transfer	local, Durango
13. Preston, Everett H.	local and interstate
14. Rio Grande Motorway	local, intra-interstate
15. Romero, James	local, Durango
16. Slim's Delivery Service	local, Durango
17. Tri-City Transfer and Storage	local, intra-interstate
18. Watson Bros. Transportation Co., Inc.	local, intra-interstate
19. Willis, Hugo	local and intrastate
Bus Lines	
1. Cannonball Bus and Tours	LaPlata County, Colorado
2. Continental Trailways Bus System	Interstate
Railways	
1. Denver and Rio Grande Western	Durango and Silverton
Airlines	
1. Frontier Airlines	Durango
2. Gregg Flying Service (Charter)	Durango
Pipelines	
1. El Paso Pipeline	Durango and connections to Texas and West Coast
2. Western Slope	Ignacio field to Alamosa

Source: University of Colorado, Local Area Statistics: San Juan and LaPlata Counties, op. cit.; "Natural Gas Pipelines Map", Oil and Gas Journal, Vol. 60, No. 15, April 9, 1962, Map supplement a copyright of the Petroleum Publishing Company, Tulsa, Oklahoma.

accounted for by residential buildings - approximately $553,000 out of a total of $864,000. 1/ Total value of construction within Durango during 1960 showed a sharp drop from previous years. The figure for 1959 was $1,387,000 and $3,117,000 in 1958. 2/ Although figures are not available, it seems reasonably certain that total value of construction increased again during 1961, due to initiation of the Lemon Dam Project on the Florida River and other major projects. Most of the construction activity has centered inthe Durango area in recent years; no building permits have been issued in San Juan County, Colorado since 1955. 3/

Local Government Activity

The study area is served by 30 different local government functions. These include 4 municipalities, 16 school districts, 8 special districts, and two county governments. 4/ The combined estimated payroll for these local government functions amounted to $1,896,000 in 1960 with an average work force of 410 persons.

Local government revenue during 1960 was estimated to be approximately $3,954,000 (Table 33). 5/ Property taxes accounted for 63.6 percent of this total. Transfer payments from state and Federal governments, primarily in the form of welfare payments, and payments to school districts, accounted for 31.7 percent. The remaining 4.7 percent was obtained from miscellaneous sources including licenses, service charges, fines and the like.

1/ University of Colorado, Local Area Statistics: LaPlata County, op. cit.
2/ Ibid
3/ University of Colorado, Local Area Statistics: San Juan County, op. cit.
4/ U.S. Dept. of Commerce, Bureau of Census, U.S. Census of Governments, 1957; Government in Colorado, Vol. VI, U.S. Government Printing Office, Washington, D. C., 1959.
5/ It was assumed that receipts constitute revenue to a local government unit if such receipts are controllable or spendable by that unit.

Table 33. Revenue Sources of Local, State and Federal Governments, Animas-LaPlata Study Area, 1960. 1/

Type of Government	Source of Revenue	Dollars	Percent of Total
Local Government			
	Property Taxes	$ 2,514,000	63.6
	Payments from State & Federal	1,255,000	31.7
	Other (liceses, fines, etc.)	185,000	4.7
	Totals	$ 3,954,000	100
State Government			
	Income Tax	270,000	17.9
	Sales Tax	450,000	29.7
	Motor Vehicle Registration	102,000	6.7
	Property Tax	99,000	6.6
	Oil and Gas Taxes-Royalties	120,700	7.9
	Gasoline Fuel Tax	472,000	31.2
	Totals	$ 1,513,000	100
Federal Government			
	Income Tax	$ 3,209,000	58.2
	Oil and Gas Taxes-Royalties	1,694,000	30.8
	Gasoline Fuel Tax	315,000	5.7
	Other	293,000	5.3
	Totals	$ 5,511,000	100
Total of State and Federal Governments		$ 7,024,000	- -

1/ Data limited to San Juan and LaPlata Counties, Colorado.

Source: Estimates developed by the authors from unpublished 1960 data furnished by the Colorado State Department of Revenue, Denver, Colorado, April 1962, and published reports of various governmental agencies.

State and Federal Government

State and Federal government units employed an average of 375 persons and paid out an estimated payroll of approximately $1,964,000 in the study area during 1960. Total revenue obtained by these units during the same year were estimated to be $7,024,000 (Table 33).

Total revenue for state government units in the study area amounted to $1,513,000. Almost two-thirds of this amount was obtained from gasoline fuel taxes and sales taxes. Income taxes accounted for almost 18 percent of the total.

Federal revenue obtained from the study area was estimated to be $5,511,000. Income taxes accounted for approximately 58 percent of this total. Oil and gas royalties and taxes accounted for 31 percent and miscellaneous sources accounted for approximately 11 percent.

Summary

An estimated 791 commercial firms in the study area carried on approximately $69,027,000 of gross business during 1960. These firms provided employment for an estimated 1,112 owner-operators and 2,956 hired workers. Local, state and Federal government units provided employment for an additional 865 persons. The total 1960 payroll for commercial sectors of the local economy amounted to approximately $10,384,000 or 52.6 percent of the total area payroll. Government payrolls accounted for an additional $3,860,000.

All secondary sectors of the local economy have been growing rapidly in recent years. This growth reflects the rapid expansion noted in the basic industries, particularly minerals and recreation. An evaluation of how these secondary sectors depend on the area's basic industries is provided in the following section.

PART III

INTERRELATIONSHIPS WITHIN THE 1960 ECONOMY

This section of the report deals with an examination of how total economic activity was produced within the study area in 1960. Attention is given to identifying all major sources of basic income and in tracing these "new" dollars through the various secondary sectors of the economy until they leave the area as "leakage". Special consideration is given to determining the amount of dependency each industry has upon basic income. An application of the inter-industry input-output technique was adopted for this purpose. 1/

The local economy of the Animas-LaPlata study area is oriented to the production of agricultural food and fiber products, minerals, manufacturing and recreation. These are considered to comprise its basic industries although in a real sense, government also brings in considerable "new" money or basic income. Agriculture, minerals, and manufacturing are handled directly in the input-output analysis. Recreation, however, must be evaluated in terms of its impact on the economy through the retail and service sectors. The "secondary" sectors of the local economy are primarily composed of commercial activities. These are generally termed "generated" business because they are mainly dependent upon the movement of new or

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1/ Considerable use was made of methodology and selected input-output coefficients developed by Mr. Richard Lund in his report, A Study of the Resources, People, and Economy of Southwestern Wyoming, op cit.

basic money through the local economy.

Explanation of the Input-Output Technique [1]

Use of the input-output technique requires the assumption that each sector of the economy can be handled as a separate industry. Even government and households are treated in this manner in addition to the more familiar industry components such as agriculture and manufacturing. The level of activity of each "industry" is measured in dollar terms initially although their impact can also be translated into labor force and physical product terms.

Table 34 was constructed to show the purchases of each industry from one another and from others outside of the local economy. This table also indicates the sales of each industry to each other as well as the export components. A special segment of the table is used to define the portion of the local economy dependent upon imports and exports from outside the study area. These latter components are tremendously important because the sales portion is responsible for sources of "new money", as indicated above, and the purchases portion represents the "leakage" of dollars from the local economy.

The inter-industry input-output model for the local economy in 1960, as shown in Table 34, summarizes all economic transactions occurring in the area that year. The separately identified section to the far right of the table, containing columns labeled "State and Federal Government" and "Exports", represents the value of commodities or services sold outside of the local economy; i.e. "basic income". Conversely, the separate section at the bottom of the table, containing rows entitled "State and Federal Govern-

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[1] Refer also to Appendix A, "Algebraic Explanation of the Input-Output Model".

Table 34. Inter-Industry Input-Output Model for the Animas-LaPlata Study Area, 1960.
($1,000's)

Sales → Purchases ↓	1 AGRI.	2 M:O&G	3 M:AO	4 MANU.	5 TRANS.	6 UTIL.	7 Wh: G.	8 Wh: F.	9 RETAIL	10 SER.	11 R & F	12 CONT.	13 L. GOV.	14 H. C.	15 S&F G.	16 EXPORT	TOTAL OUTPUT
1. AGRICULTURE	312	-	-	639	93	-	56	100	46	1	-	-	-	-	486	2,330	4,063
2. MINERALS: OIL & GAS	-	226	-	1	-	1,272	-	-	-	-	-	-	-	-	-	3,376	4,875
3. MINERALS: ALL OTHER	-	-	1	13	-	12	-	-	-	-	-	2	-	179	-	7,531	7,738
4. MANUFACTURING	33	37	15	13	1	9	11	1	505	42	40	50	20	420	-	3,132	4,329
5. TRANSPORTATION	103	119	7	225	-	53	199	5	582	27	6	63	21	407	7	2,921	4,745
6. UTILITIES	50	12	462	111	116	152	62	8	437	380	233	27	169	1,161	21	3,550	6,951
7. WHOLESALE: GENERAL	221	65	12	260	120	744	130	63	4,009	1,047	97	79	88	83	162	6,905	14,085
8. WHOLESALE: FARM	209	-	-	-	-	-	-	-	-	-	-	-	-	-	-	770	979
9. RETAIL TRADE	438	167	116	146	63	263	339	77	576	456	350	293	283	17,602	27	6,113	27,309
10. SERVICES	74	284	56	102	33	174	82	10	246	247	196	65	335	2,359	3	2,576	6,842
11. RENTALS & FINANCE	85	63	1	129	20	131	93	8	473	285	282	28	14	923	13	1,595	4,143
12. CONTRACTORS	68	88	531	116	1	20	192	1	57	49	186	265	48	510	6	1,835	3,973
13. LOCAL GOVERNMENT	438	158	195	42	73	603	54	6	391	71	404	32	-	232	1,255	-	3,954
14. HOUSEHOLD CONSUMPTION PAYROLL	326	1,769	2,172	1,236	2,361	1,571	833	127	2,850	1,186	704	752	1,896	-	1,964	-	19,747
PROFIT & OTHER	1,277	868	771	306	1,011	74	215	36	2,163	1,123	741	237	470	-	1,445	2,608	13,345
15. STATE-FEDERAL GOV.	106	211	101	275	216	194	1,554	6	579	88	78	41	34	3,541	-	-	7,024
16. IMPORT	323	808	3,298	715	637	1,679	10,265	531	14,395	1,840	826	2,039	576	5,675	1,635	-	45,242
TOTAL INPUT	4,063	4,875	7,738	4,329	4,745	6,951	14,085	979	27,309	6,842	4,143	3,973	3,954	33,092	7,024	45,242	179,344

Source: Estimates prepared by the authors.

ment" and "Imports" represents money leaving the economy--"leakage". The remaining large section of the table represents the "producing sectors" of the economy, or in other words, the activity taking place among the various industries within the local economy.

The usefulness of Table 34 is limited to examination of aggregate economic relationships in the study area. Conversion of these data to a percentage basis, however, allows for a more critical analysis of sales and purchasing patterns. By dividing the figures in each column by the total of the column, a decimal equivalent or coefficient is obtained. These decimal amounts indicate the distribution of a particular industry's purchases from all other industries as a fractional amount of total purchases. (The total of each column is 1.000.)

Table 35 presents the input-output coefficients of the dollar values for the 1960 situation shown in the previous table. It shows, for example, that of each dollar of agricultural output, about 8 cents (.0768) is used to purchase products from within the agricultural industry. In other words, not all agricultural sales are made to non-farmers; operators buy some machinery, feed and the like from each other. Following down through the agriculture column, one can determine, for example, that eight cents of each dollar was used to purchase labor, 11 cents was paid out in the form of local taxes, and the like. The same technique can be used to examine the inputs and outputs of each of the industries represented.

Further application of these coefficients was made in the development of projections for the local economy included in Part IV. The need for such data in developing regional economic projections was stated recently by Richard Ruggles and Nancy Ruggles as follows: "The Analysis of

Table 35. Input-Output Coefficients for Direct Purchases per Dollar of Total Activity, Animas-LaPlata Study Area, 1960.

Sales → / Purchases ↓	1 AGRI.	2 M: O&G	3 M:AO	4 MANU.	5 TRANS.	6 UTIL.	7 Wh: G.	8 Wh: F.	9 RETAIL	10 SER.	11 R&F	12 CONT.	13 L.GOV.	14 H.C.	15 S&F G.	16 EXPORT	TOTAL OUTPUT
1. AGRICULTURE	.0768	-	-	.1476	.0196	-	.0040	.1021	.0017	.0001	-	-	-	-	.0692	.0515	.0227
2. MINERALS: OIL & GAS	-	.0464	-	.0002	-	.1830	-	-	-	-	-	-	-	-	-	.0746	.0272
3. MINERALS: ALL OTHER	-	-	.0001	.0030	-	.0017	-	-	-	-	-	.0005	-	.0054	-	.1665	.0431
4. MANUFACTURING	.0081	.0076	.0020	.0030	.0002	.0013	.0008	.0010	.0185	.0061	.0097	.0126	.0051	.0127	-	.0692	.0241
5. TRANSPORTATION	.0254	.0244	.0009	.0520	-	.0076	.0141	.0051	.0213	.0040	.0014	.0159	.0053	.0123	.0010	.0646	.0265
6. UTILITIES	.0123	.0025	.0597	.0256	.0244	.0219	.0044	.0082	.0160	.0555	.0562	.0068	.0427	.0351	.0030	.0785	.0388
7. WHOLESALE: GENERAL	.0544	.0133	.0016	.0601	.0253	.1070	.0092	.0644	.1468	.1530	.0234	.0199	.0223	.0025	.0231	.1526	.0785
8. WHOLESALE: FARM	.0515	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.0170	.0055
9. RETAIL TRADE	.1078	.0343	.0150	.0337	.0133	.0378	.0241	.0787	.0211	.0667	.0845	.0737	.0716	.5319	.0038	.1351	.1523
10. SERVICES	.0182	.0582	.0072	.0236	.0070	.0250	.0058	.0102	.0090	.0361	.0473	.0164	.0847	.0713	.0004	.0569	.0381
11. RENTALS & FINANCE	.0209	.0129	.0001	.0298	.0042	.0189	.0066	.0082	.0173	.0417	.0681	.0070	.0035	.0279	.0018	.0353	.0231
12. CONTRACTORS	.0167	.0180	.0686	.0268	.0002	.0029	.0136	.0010	.0021	.0072	.0449	.0667	.0121	.0154	.0009	.0406	.0221
13. LOCAL GOVERNMENT	.1078	.0324	.0252	.0097	.0154	.0868	.0038	.0061	.0143	.0104	.0975	.0081	-	.0070	.1787	-	.0220
14. HOUSEHOLD CONSUMPTION PAYROLL	.0802	.3629	.2807	.2855	.4976	.2260	.0592	.1297	.1044	.1733	.1699	.1893	.4795	-	.2796	-	.1101
PROFIT & OTHER	.3143	.1781	.0996	.0707	.2131	.0106	.0153	.0368	.0792	.1641	.1789	.0596	.1189	-	.2057	.0576	.0744
15. STATE-FEDERAL GOV.	.0261	.0433	.0131	.0635	.0455	.0279	.1103	.0061	.0212	.0129	.0188	.0103	.0086	.1070	-	-	.0392
16. IMPORT	.0795	.1657	.4262	.1652	.1342	.2416	.7288	.5424	.5271	.2689	.1994	.5132	.1457	.1715	.2328	-	.2523
TOTAL INPUT	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

projected changes in various industries depends upon our ability to make adequate measurements of output in real terms, thus, a better understanding of productivity growth and technological change in the economy, as related to the production taking place in different industries, will in the last analysis require input-output information". 1/

Analysis of Inter-Industry Relationships

An explanation of the inter-industry relationships in the local economy during 1960 can best be accomplished by use of Table 34 previously referred to. Total input was made to equal total output, as indicated by the $179.3 million figure in the lower right-hand corner of the table. 2/ This figure and the total household consumption figure, $33,092,000, are the two most important numbers in the table. The latter figure represents total welfare resulting from overall interreactions of approximately $179 million worth of activity in the local economy. 3/ The remaining figures serve simply to demonstrate the interdependence among the various sectors of the economy.

Patterns of Input and Output

Each entry in Table 34 is a sale from the viewpoint of the industry listed at the left of the row and at the same time each entry represents a

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1/ R. Ruggles and N.D. Ruggles, "Regional Breakdowns of National Economic Accounts," Design of Regional Accounts, the Johns Hopkins Press, Baltimore, Maryland, 1961, p. 129.

2/ It is generally recognized that only in the long run do receipts equal disbursements. Unless they were made to equal each other in the 1960 situation shown in Table 34, however, the input-output technique would be inoperative. This assumption also allows for the separate handling of savings and investments so that their special effect on the economy can be ascertained.

3/ The total output figure for Households, $33,092,000 is essentially the same as "realized personal income" as defined by the Department of Commerce.

purchase from the viewpoint of the industry listed at the top of each column. Thus, in other words, each industry's row shows its total receipts and each industry's column shows its total expenditures.

Local government is treated as an industry in the local economy. The figures appearing in its row in the table indicate taxes and other revenue collected by local governments instead of the sales shown for the other industries. Local government can be considered as selling "services" to each industry for which it is reimbursed through payment of taxes and operating fees. The household sector is likewise considered an industry in Table 34. The figures in its rows represent payroll, profit and other receipts accumulated by the total population in the study area during 1960. Households may be viewed as "selling" their labor and management services to each of the industries listed in the columns in the table.

Distribution of Business Transactions

Agriculture can be used to demonstrate an industry's business transactions. Output is considered initially. During 1960, total agricultural sales amounted to approximately $4.06 million. Approximately 57 percent of this amount, $2,330,000, was sold to buyers located outside of the local study area; i.e., "exported." This represented the bulk of agriculture's contribution of "new" money to the local economy. In addition, however, the agricultural industry received approximately $486,000 from the Federal government in the form of various support payments including subsidies to wool growers and agricultural stabilization payments. This income from the Federal government is similar to the export component of agriculture's sales in its effect on the local economy because it too represents new money entering the area.

Approximately 43 percent of agricultural sales were made to other industries in the local economy, i.e. within the "processing sector". Sales among farmers amounted to $312,000. Sales to food processing firms amounted to approximately $639,000. Other significant purchasers in the area included transportation and wholesale firms.

Agriculture "spent" approximately $4.06 million dollars in order to produce a total of $4.06 million dollar output, since we assumed that output equalled input during 1960. The distribution of its total expenditures can be determined by tracing down the agriculture column. Approximately $312,000 was spent in purchasing feed, machinery and the like from local farmers. Likewise, farmers purchased $221,000 of goods from general wholesalers and $209,000 from farm wholesale firms. Approximately $1.6 million appears as household consumption. Some $326,000 of this amount was spent on payroll and the remaining $1,277,000 represents profits and other receipts of farm operators. Agriculture also made some purchases from outside of the local economy, $323,000, such as purchases from mail order houses and the like.

The Processing Sector

The intermediate or processing sector of the local economy is represented by the first 14 rows and columns in Table 34. This portion of the table indicates the flow of dollars among local industries. All interindustry transactions taking place within the study area are represented.

No distinction between the basic and commercial industries is made in this presentation. Although a careful analysis of the data will reveal the degree of interdependence between the basic and commercial phases which exist in the area, a more complete evaluation is carried out in a following section of the report entitled, "Multiplier Effects of Basic Income".

Basic Income Generating Sector

The basic income generating sector of the local economy is represented by the last two columns in Table 34, identified as "State and Federal Government" and "Export". These represent more than merely a residual for the totals of each industry after the processing activities have been identified. That portion of the total output appearing in these columns determines the production level of the processing sector. This is also more fully explained in the "Multiplier Effects of Basic Income" section.

Identification of Total Output Components

Overall, total output, as indicated in Table 34, represents total sales activity for each of the industries identified. For some industries, however, slight variations in the sales definition were required. Output for each industry is defined briefly below.

Total agricultural output is represented by total dollars received by farmers and ranchers for all products and equipment sold and all Federal Government payments received. The value of products shipped from the local area was used as the measure of output for the mineral industries. In this manner, the mineral producer was regarded as a local entity even though in many instances the home office is located outside of the study area. Services and other purchases from their home offices show up in the import row of Table 34, since dollars paid out in this manner leave the local economy.

Total output for transportation represents total services performed by local people and is based on the amount paid to local employees, taxes, and local purchases of goods and services. Total output for the government components include taxes and other revenue collected. The total output for the rentals and finance component is made up of interest earned, commissions, dividends, service charges, rental charges and the like. Total output is identical to gross sales for all other industry components identified in the table.

Multiplier Effects of Basic Income

Basic income was previously defined in this report as "new" money entering the local economy because of sales made to buyers living outside of the study area. Certain industries were identified as "basic" because they were major generators of basic income. It must be recognized, however, that these so-called basic industries also depend to some extent upon local market sales. On the other hand, the "secondary" industries also generate some basic income through sales to buyers located outside of the study area. The latter case is especially important in the case of service and retail trade sales to tourists and other travelers. This section of the report, therefore, deals with basic income generating activities in the broad sense instead of limiting the analysis to that portion generated by the so-called "basic" industries.

The concept of basic income (export sales and government payments) as a generator of economic activity in the processing sector is based upon the assumption that the processing sector as a unit has a definite relationship to the export sector as a unit and to the total output column as a unit. 1/ This assumption regarding all industries identified in Table 34 is simply an extension of assumptions applied earlier for determining the sub-items in the sales row and purchases column of each industry.

Since these three units - processing sector, export sector, and total output - were assumed to have a definable relationship, it was possible to

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1/ This means more specifically that the input coefficients previously described were assumed to remain constant regardless of the level of output by an industry. Of course this does not hold completely true when one considers the individual items included in an industry's purchasing pattern but when aggregate purchases are considered, the pattern of purchases does not change significantly as output increases.

manipulate them through use of matrix algebra. The results of such an algebraic manipulation allows a determination of both direct and indirect economic activity resulting from a single dollar of basic income entering the economy. (Table 36)

Table 37 shows the overall effect of basic income working its way through the local economy. This table was constructed by applying the factors per dollar of basic income shown in Table 36 to total basic income generated by each of the various industrial and commercial activities. Entire units were manipulated instead of dealing only with individual entries in each business sector as was carried out previously in developing the inter-industry input-output model shown in Table 34. Table 37 indicates that the major basic income-producing activities in the study area include the agricultural, mineral, and manufacturing industries, the traveler-oriented phases of retail trades and services, transportation-utilities, and purchases and payments of state and Federal Governments.

A business-generating factor for each of these industries is shown also in Table 37. The largest amount of additional business was produced by the export component of the agricultural industry; each dollar of basic income received through export generated an additional $1.36 of secondary business. Wholesaling ranked lowest with each dollar of export producing only $.30 worth of additional local business. Even though wholesaling accounted for the largest single unit of export, $7,675,000, it therefore produced only $2,300,000 worth of additional business.

An overall total of $50,631,000 worth of export sales and other basic income-generating activity took place in the study area during 1960. Approximately $43,859,000 worth of additional business was produced, or in other words, each dollar of basic income produced an average of $.87 worth of

Table 36. Direct and Indirect Activity per Dollar of Basic Income, Animas-LaPlata Study Area, 1960.

	1 AGRI.	2 M: O&G	3 M: AO	4 MANU.	5 TRANS.	6 UTIL.	7 W'SALE GEN.	8 W'SALE FARM	9 RETAIL TRADE	10 SERV.	11 R & F	12 CONT.	13 L. GOV.	14 H. C.
1. AGRICULTURE	1.0980	.0079	.0046	.1683	.0279	.0059	.0060	.1150	.0085	.0064	.0075	.0060	.0075	.0081
2. MINERALS: OIL & GAS	.0142	1.0604	.0190	.0155	.0161	.2053	.0029	.0069	.0080	.0192	.0221	.0071	.0199	.0142
3. MINERALS: ALL OTHERS	.0046	.0049	1.0036	.0072	.0056	.0053	.0008	.0021	.0020	.0035	.0042	.0030	.0052	.0073
4. MANUFACTURING	.0336	.0320	.0190	1.0254	.0259	.0212	.0054	.0135	.0286	.0240	.0326	.0265	.0304	.0326
5. TRANSPORTATION	.0584	.0541	.0216	.0821	1.0308	.0356	.0198	.0228	.0361	.0277	.0293	.0333	.0360	.0379
6. UTILITIES	.0739	.0611	.0988	.0797	.0838	1.0700	.0151	.0360	.0416	.1000	.1150	.0372	.1034	.0739
7. W'SALE: GENERAL	.1901	.1338	.0845	.1764	.1454	.2058	1.0332	.1332	.1997	.2509	.1463	.0897	.1574	.1450
8. W'SALE: FARM	.0565	.0004	.0002	.0087	.0014	.0003	.0003	1.0059	.0004	.0003	.0004	.0003	.0004	.0004
9. RETAIL TRADE	.6042	.5435	.3668	.4839	.5802	.4205	.1111	.3079	1.2288	.4222	.5216	.3324	.5971	.7379
10. SERVICES	.1096	.1469	.0677	.1016	.0988	.1066	.0210	.0502	.0459	1.0996	.1323	.0605	.1727	.1159
11. RENTAL & FINANCE	.0708	.0617	.0324	.0762	.0543	.0590	.0156	.0329	.0391	.0803	1.1162	.0327	.0548	.0625
12. CONTRACTORS	.0452	.0446	.0897	.0545	.0262	.0279	.0192	.0150	.0154	.0290	.0738	1.0844	.0380	.0318
TOTAL BUSINESS MULTIPLIER	2.3591	1513	1.8079	2.2795	2.0964	2.1634	1.2504	1.7414	1.6541	2.0631	2.2013	1.7131	1.2228	1.2669
13. LOCAL GOVERNMENT	.1504	.0641	.0498	.0587	.0494	.1193	.0109	.0337	.0308	.0414	.1362	.0257	1.0343	.0366
14. HOUSEHOLD CONSUMPTION	.8110	.8733	.5992	.7330	.9894	.6289	.1451	.3657	.3461	.5934	.7167	.4342	.9037	1.3066

Table 37. Sources of Basic Income and Its Effect on Various Sectors of the Economy, Animas-LaPlata Study Area, 1960 1/
($1,000's)

	AGRICULTURE		OIL & GAS		OTHER MINERALS		MANUFACTURING		TRANS-UTILITIES		WHOLESALE		TRAVELERS		CONSTRUCTION		STATE-FEDERAL GOVERNMENT		ALL OTHER		GRAND TOTALS	
	Export Value	Produced Business	Export Value	Produced Business	Export Value	Produced Business	Export Value	Produced Business	Export Value	Produced Business	Export Value	Produced Business	Export Value	Produced Business	Export Value	Produced Business	Purchases (Direct)	Produced Business	Export Value	Produced Business	Basic Income	Produced Business
1. Agriculture	2,330	228		27		35		527		102		130		60		20	486	136		40	2,816	1,305
2. Minerals		44	3,376	220	7,531	170		71		811		33		108		30		124		48	10,907	1,659
3. Manufacturing		78		108		143	3,132	79		151		48		207		79		198		83	3,132	1,174
4. Trans. & Utilities		308		389		907		507	6,471	710		286		717		215	28	581		218	6,499	4,838
5. Wholesale		575		453		638		580		1,160	7,675	338		1,654		380	162	766		292	7,837	6,836
6. Retail		1,408		1,835		2,762		1,515		3,188		1,004	5,135	2,228	978	866	27	3,503		1,512	6,140	19,821
7. Services		256		496		510		318		667		184	2,494	484	77	164	3	766	5	291	2,579	4,136
8. Rentals & Finance		165		208		244		239		368		133		401		104	13	17[illegible]	1,595	69	1,608	2,105
9. Contractors		105		151		675		171		176		144		151	1,835	172	6	176		64	1,841	1,985
10. Local Government																	1,255				1,255	
11. Household Consumption																	3,409		2,608		6,017	
TOTALS	2,330	3,167	3,376	3,887	7,531	6,084	3,132	4,007	6,471	7,333	7,675	2,300	7,629	6,010	2,890	2,030	5,389	6,424	4,208	2,617	50,631	43,859
Business Generator		1.359		1.151		.808		1.279		1.133		.300		.788		.702		1.192		.622		.866
Local Gov. Revenue		350		216		375		184		5[illegible]8		101		261		80		1,306*		313		3,95[illegible] *
State-Fed. Revenue		316		506		534		260		941		1,552		829		225		1,138		723		7,024
Realized Personal Income		1,890		2,948		4,513		2,296		5,123		1,284		3,257		1,181		6,046*		4,554*		33,092*

1/ Data limited to San Juan and LaPlata Counties, Colorado
*Includes both basic and produced income
Source: Estimates by the authors

additional local business. The $50.6 million dollars of basic income resulted also in a total realized personal income of $33,092,000 in the study area. Each of the major sectors of the local economy which contributed to the production of additional business and to total realized personal income is discussed below.

Agriculture

Approximately 57 percent or 2.3 million dollars worth of total agricultural output were "exported" from the study area. This amount produced an additional $3,167,000 worth of local business and resulted in a realized personal income of $1,890,000. Each dollar of agricultural export therefore produced an additional $1.36 of local business. Of this new business, 44.4 percent or $1,408,000 was accounted for in the retail trade category. Another major share of new business produced by agricultural exports, $575,000, emerged in the wholesale trade category. The smallest single component of produced business, $44,000, went to the minerals category.

Agricultural exports also produced $350,000 of local government revenue and $316,000 of state and Federal revenue. Revenue going to state and Federal governments came primarily from income tax payments whereas the local government revenue represents direct payments of property taxes by local farmers and ranchers.

Minerals

The mineral industries exported $10,907,000 worth of sales which amounts to 86.5 percent of total output. The oil and gas component exported $3,376,000 and had a business generator of $1.15. The other minerals component exported $7,531 to which a business generator of approximately $.81 was applied.

A combined total of $9,971,000 worth of additional business was produced and realized personal income attributable to this source amounted to $7,461,000.

The mineral industries have their greatest impact on the local economy through payrolls, taxes, and oil and gas royalties. Their purchases of goods produced by other local industries is relatively insignificant. Local government revenue attributable to mineral exports amounted to $591,000 while state and Federal government revenues totaled $1,040,000. This amounted to 15 percent of total local government revenue and approximately 15 percent of state and Federal government revenues.

Manufacturing

Seventy-two percent of manufacturing output was "exported" during 1960. Lumber and processed agricultural products accounted for almost all of the export component. Due to a high business generator for manufacturing exports, a total of $4,007,000 additional local business was created. The major local industry components benefiting from this activity, in order of magnitude, include retail trades, wholesale firms, agriculture, and transportation-utilities. In addition, $2,296,000 of realized personal income was generated. This amounted to approximately 7 percent of total realized personal income in the study area. Local government revenues amounted to $184,000 and state-Federal government revenues totaled $260,000.

Transportation and Utilities

These two components of the local economy exported $6,471,000 worth of services or 55 percent of their total output. Each dollar of this basic income produced an additional $1.13 worth of local business or an overall total of $7,333,000. A total of $5,123,000 of realized personal income resulted from this activity. It also produced significant amounts of government revenue; 14.3 percent of local government revenue ($568,000) and 13.4 percent ($941,000) of state and Federal government revenues.

The export component of the transportation industry consists largely of services provided in the area for thru transportation. In the case of the utilities it is accounted for primarily by firms selling to buyers of gas and electricity who live outside of the study area. This service is considered to be worth the same as the expenditures made locally, in the form of payrolls, taxes and the like, to provide this service.

Wholesale

Approximately 51 percent of total wholesale output or $7,675,000 emerged as basic income. Even with an extremely low business generating factor of $.30, an additional $2,300,000 worth of local business was produced. The wholesaling industry accounted for $1,284,000 of realized personal income. This activity also accounted for $101,000 of local government revenue and $1,552,000 of state and Federal government revenue. (State and Federal taxes on gasoline and other petroleum products were considered collected at the wholesale level which accounted for a significant share of the state-Federal figure.)

Travelers

Table 37 allows for an evaluation of the role of sales to travelers in the local economy through their impact on the retail and service categories. Overall, travelers brought $7,629,000 worth of basic income into the area which in turn produced an additional $6,010,000 of local business. Thirty-seven percent of this additional business was retained by the retail firms and an additional 27.5 percent emerged in the wholesale category.

Basic income emanating from travelers was estimated to account for $3,257,000 of realized personal income or almost 10 percent of the total for the study area. This basic income was also responsible for $261,000 of local government revenue and for $829,000 of state and Federal government revenue. The relatively high figure in the latter case is due primarily to excise taxes on many of the things that travelers, especially tourists, normally purchase.

It was estimated earlier that tourists and other recreation seekers accounted for approximately $4,095,000 in local sales, or 54 percent of the total attributable to travelers (Table 18). The remainder is accounted for primarily by truck drivers and business men traveling through the area. Durango offers one of the last stop-over spots for travelers heading west, for example, and as a result many thru-travelers spend a night there.

Approximately one-third of the basic income attributable to travelers enters the local economy through the services category. Due to a higher business generator for services, $1.06 compared to approximately $.65 for retail, this component is especially significant.

Construction

Three sectors of the local economy - retail trade, services, and contractors - accounted for $2,890,000 of basic income attributable to construction activity. This combined activity resulted in $2,030,000 worth of additional local business and for $1,181,000 of realized personal income. In addition, it generated $80,000 local government revenue and $225,000 state and Federal government revenue.

Contractors accounted for $1,835,000 or 63 percent of total basic income generated by construction activities. Major construction projects underway in the area during 1960 included accelerated construction for oil and gas developments, home construction, some highway renewal, and preliminary work on Lemmon Dam. Almost 43 percent of the additional produced local business went to the retail trade category. Significant amounts also went to the transportation-utilities and wholesale trade sectors.

State and Federal Government Expenditures

Money "spent" in the study area by state and Federal governments was considered to represent basic income whereas the payment of taxes to these government components is represented as leakage of funds from the area. This assumption is necessary because total state and Federal government revenue (total input/output) has no direct relationship to the amount of money spent locally by these government components. As noted earlier, however, all local government activity was considered a part of the local economy.

Payments and purchases (basic income) going to the study area was exceeded by outgo in the overall picture for state and Federal government revenue (Payments and purchases amounted to $5,389,000 while revenues collected amounted to $7,024,000.) The largest component of the basic income side of the ledger, approximately $3,409,000 or 63 percent of the total, went directly to households. Overall, basic income from state and Federal government sources generated $6,424,000 worth of local business and was responsible for $6,046,000 or 18.3 percent of total realized personal income in the area.

Other Sources of Basic Income

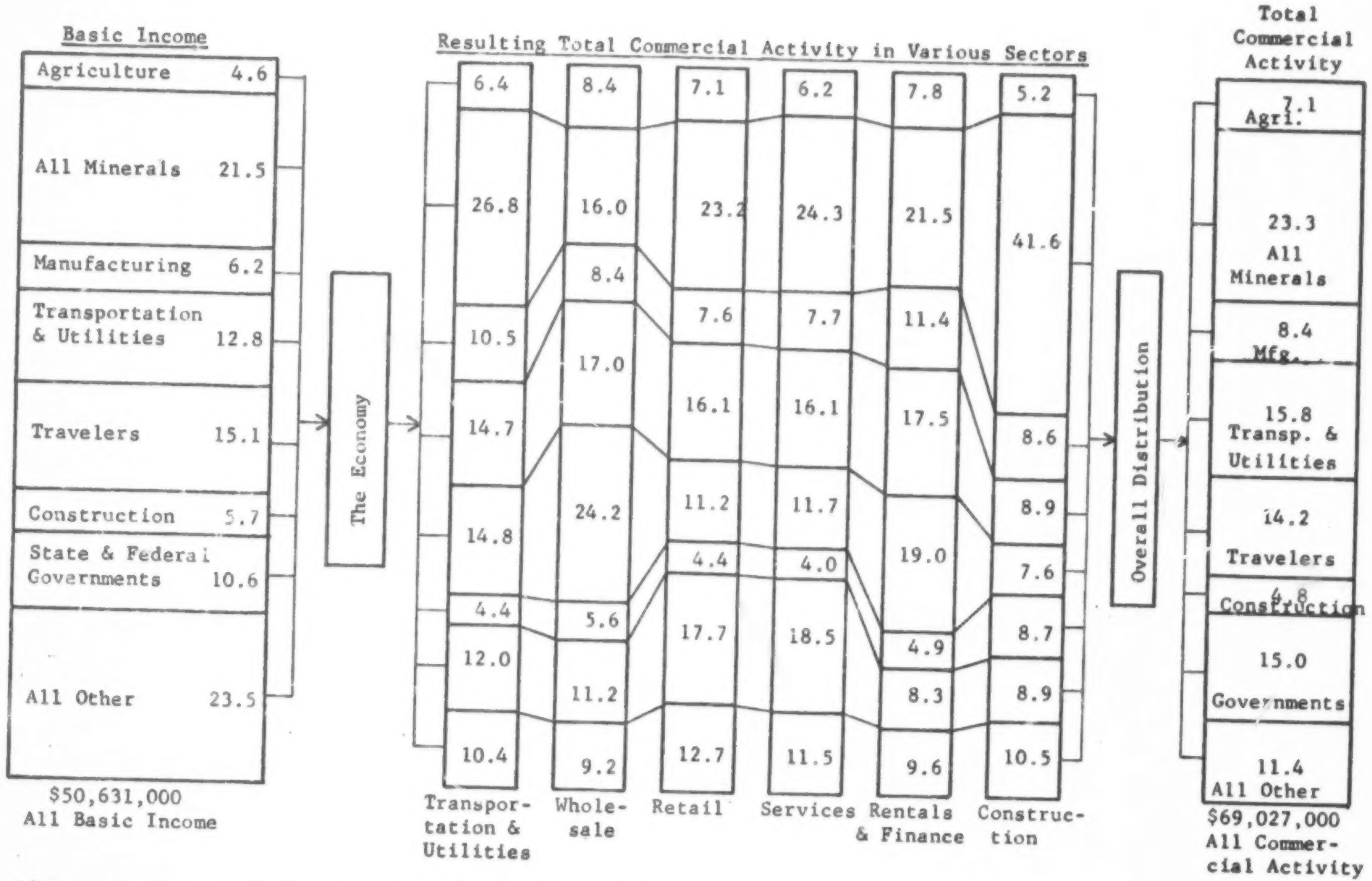
Approximately $4,208,000 of basic income entered the local economy from miscellaneous sources. The largest single component, $2,608,000, was received directly by the Household sector in the form of returns on investments, dividends and the like. Another significant amount, $1,595,000, was realized by activities in the Rental and Finance categories. Total basic income from these miscellaneous sources generated $2,617,000 worth of local business and accounted for $4,554,000 of realized personal income. Local government revenue in the amount of $313,000 and state-Federal government revenue totaling $723,000 was also produced. When all miscellaneous sources in the "All Other" class are considered, each dollar of basic income in this category produced an additional $.62 worth of local business.

Origin of Commercial Activity

Total commercial activity in the study area in 1960, including basic and produced business, amounted to $69,027,000. An analysis of the origin of this amount of business requires a look from another point of view at the data contained in Table 37. Major consideration was given in the previous section to how much basic income was generated in each sector of the local economy. This section, however, will deal with how much of each commercial sector's business is attributable to various basic income producers.

Figure 12 shows these relationships in summary form. They were developed under the assumption that all commercial activity in the study area can be traced to overall production of basic income through export and state-Federal purchases and payments--the same assumption previously stipulated. It shows how the $50,631,000 of produced basic income resulted in an overall $69,027,000 of activity in the commercial sectors, as well as the distribution of this activity among the various commercial components. The figures in each case are shown as percentages and include, of course, any basic income generated

Figure 12 - Basic Income Origin of Commercial Activity by Commercial Firms, Animas-La Plata Study Area, 1960[1]
(Percentage Distribution)


Basic Income
Agriculture 4.6
All Minerals 21.5
Manufacturing 6.2
Transportation & Utilities 12.8
Travelers 15.1
Construction 5.7
State & Federal Governments 10.6
All Other 23.5
$50,631,000
All Basic Income
The Economy
Resulting Total Commercial Activity in Various Sectors
6.4
26.8
10.5
14.7
14.8
4.4
12.0
10.4
Transportation & Utilities
8.4
16.0
8.4
17.0
24.2
5.6
11.2
9.2
Wholesale
7.1
23.2
7.6
16.1
11.2
4.4
17.7
12.7
Retail
6.2
24.3
7.7
16.1
11.7
4.0
18.5
11.5
Services
7.8
21.5
11.4
17.5
19.0
4.9
8.3
9.6
Rentals & Finance
5.2
41.6
8.6
8.9
7.6
8.7
8.9
10.5
Construction
Overall Distribution
Total Commercial Activity
7.1 Agri.
23.3 All Minerals
8.4 Mfg.
15.8 Transp. & Utilities
14.2 Travelers
4.8 Construction
15.0 Governments
11.4 All Other
$69,027,000
All Commercial Activity

1/Data limited to San Juan and La Plata Counties, Colorado within the commercial sector. Separate distributions are shown for six components - 1) Transportation and Utilities; 2) All Wholesale; 3) All Retail; 4) Services; 5) Rentals and Finance; and 6) Construction. The basic income source groupings are idential to those included in Table 37 with the exception that basic income from wholesale activities is now included in the All Other category.

Figure 12 is more easily understood if the origin of overall commercial activity is considered initially. Production of basic income by the Mineral industries was the greatest contributor to total commercial activity, approximately 23 percent of the total. The Transportation-Utilities category followed with a contribution of 15.8 percent. Other large contributors were State-Federal purchases and payments with 15.0 percent, and the Travelers category with 14.2 percent. The "All Other" category contributed 11.4 percent but this in turn was a combination of income from rentals and finance, wholesale, and other miscellaneous sources.

The relative importance of various sources of basic income to individual components of the commercial sector varies considerably. Basic income from Minerals, for example, contributed only 16.0 percent of total activity in the Wholesale category but accounted for 41.6 percent of total activity in construction. The Travelers component on the other hand, was extremely important to the Wholesale category, where it contributed 24.2 percent of the total, while contributing only 7.6 percent to Construction category. Agriculture contributed at a more or less consistent rate to all categories, ranging from a low of 5.2 percent of Construction to a high of 8.4 percent of the Wholesale category.

The relationship between the magnitude of basic income from each source and the proportion of commercial activity generated by it, can also be ascertained from Figure 12. The agricultural, mining, manufacturing, and transportation and utilities categories produced a higher percentage of total commercial activity than their respective percentages of total basic income production. Agriculture, for example, accounted for 4.6 percent of total basic income produced but generated 7.1 percent of total commercial activity. In addition to the above listing, the State-Federal category generated a higher percentage of total commercial activity than its share of the basic income total. The Travelers, Construction and "All Other" categories produced a lower percentage of total commercial activity than their share of the basic income total. These relationships are important primarily because they indicate that dollar for dollar of basic income produced, some industries generate more total commercial activity than others; this, of course, was explained in the previous section but in Figure 12, a graphic representation is provided.

Estimate of Gross Regional Product

Gross regional product[1/] as developed for the Animas-LaPlata Study Area is an attempt to provide an additional measure of the economic performance of the area. It provides a means for direct comparison to the nation as a whole. Table 38 shows the estimated product flow or expenditures by the major sectors for final goods and services. These expenditures are limited to items which have undergone all phases of production and distribution. It was estimated that gross regional product amounted to about $38.2 million in 1960. The percentage distribution of these expenditures for production are shown for the study area compared with 1954 New Mexico gross state product and 1954 United States gross national product.

[1/] The methods of estimating the final flow of goods and services to determine GRP for the area are modeled after a system of product and income statistics for the year 1954 published in New Mexico Business, July 1957, by the Bureau of Business Research, University of New Mexico, Albuquerque, N. M.

Table 38. Estimated Gross Regional Product, Animas-LaPlata Study Area, 1960, compared with 1954 Gross State Product for New Mexico and 1954 Gross National Product for the United States.

		Study Area - 1960 1/			
		Amount ($1,000's)	Percent of Area's GRP	Percent of 1954 New Mexico GSP	Percent of U.S. 1954 GNP
HOUSEHOLD SECTOR					
Personal Consumption Expenditures		23,644	61.8	56.9	65.5
Durable Goods	8,512		(22.3)	(11.5)	(8.1)
Non-Durable Goods	10,404		(27.2)	(30.9)	(33.7)
Services	4,728		(12.3)	(14.4)	(23.7)
BUSINESS SECTOR					
Gross Private Domestic Investment		4,223	11.0	22.1	12.9
New Construction	3,329		(8.7)	(18.3)	(7.7)
Producer's Durable Equipment	894		(2.3)	(4.3)	(6.2)
Change in Business Inventories	-		(-)	(-0.5)	(-1.0)
OUT-OF-REGION SECTOR					
Net Export of Goods and Services		1,635	4.3	-4.3	-0.1
GOVERNMENT SECTOR					
Government Purchases of Goods and Services		8,733	22.9	25.3	21.7
State and Federal	5,389		(14.1)	(15.4)	(14.0)
Local	3,344		(8.8)	(9.9)	(7.7)
GROSS PRODUCT AND PERCENTAGE TOTALS		38,235	100.0	100.0	100.0

1/ Data limited to San Juan and LaPlata Counties, Colorado

Source: Study area estimates prepared by the authors; data for New Mexico and the United States obtained from: S.J. Brasher, "Income and Product in New Mexico", New Mexico Business, Bureau of Business Research, University of New Mexico, Albuquerque, New Mexico, Vol. 10, No. 7, July 1957, p. 5.

Figure 13 shows the interrelationships in the flow of income and product for the study area. 1/ It shows, for example, that personal consumption expenditures are made from disposable personal income; gross private domestic investment is derived from corporate and personal savings; and government purchases of goods and services are financed through taxes and other revenue sources.

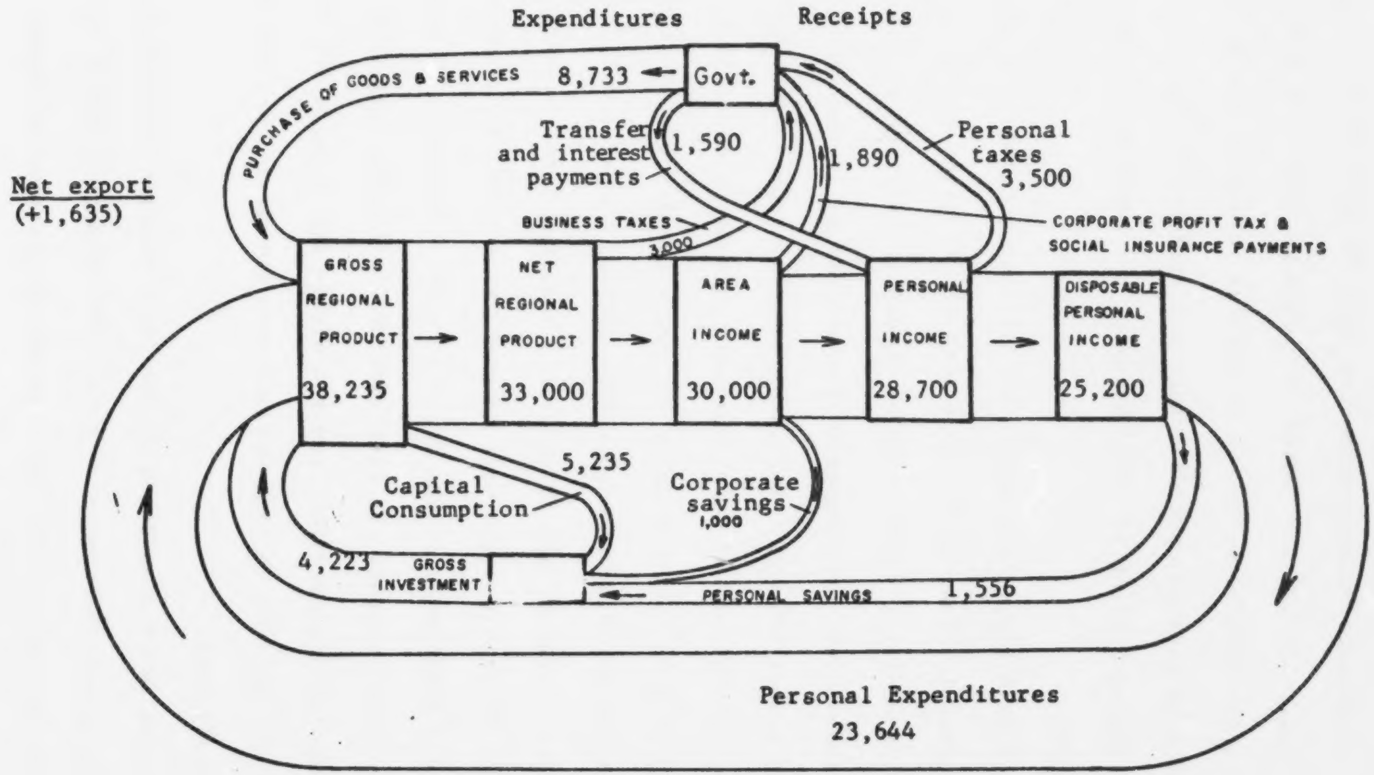
The amounts shown for the study area are strictly estimates, of course, and therefore are subject to an unknown degree of error. For the most part, however, they were drawn from reasonably accurate data developed for the overall economic base study of the area so they are considered accurate enough for use in initial planning reports. The significance of this measure of economic performance is not limited to the accuracy of the amounts shown, but rather in its ability to provide a picture of the interrelationships involved in the flow of funds through the major sectors of the area's economy.

Summary for Part III

Part III provides an analysis of total economic activity which took place in the Animas-LaPlata study area during 1960. The inter-industry input-output model (Table 34) illustrates how various sectors of the local economy were involved in producing a total dollar output of $179,344,000 and in the generation of $33,092,000 of local realized personal income (or household consumption). Special emphasis is given to identifying the role of various components of basic income produced by the various sectors of the local economy.

1/ Refer to New Mexico Business, July, 1957 for a detailed discussion of income-and-product accounting in estimating gross product.

Figure 13 - Estimated Flow of Income and Product, Animas-La Plata Study Area, 1960
(Annual Flows, in thousands of dollars)


Expenditures
Receipts
Govt.
PURCHASE OF GOODS & SERVICES
8,733
Transfer and interest payments
1,590
1,890
Personal taxes
3,500
BUSINESS TAXES
3,000
CORPORATE PROFIT TAX & SOCIAL INSURANCE PAYMENTS
Net export
(+1,635)
GROSS REGIONAL PRODUCT
38,235
NET REGIONAL PRODUCT
33,000
AREA INCOME
30,000
PERSONAL INCOME
28,700
DISPOSABLE PERSONAL INCOME
25,200
Capital Consumption
5,235
Corporate savings
1,000
4,223
GROSS INVESTMENT
PERSONAL SAVINGS
1,556
Personal Expenditures
23,644

Source: Estimates by the authors.
This chart was modeled after a flow chart published in New Mexico Business, July 1957.

Four basic industries - agriculture, minerals, manufacturing, and recreation - play significant roles in the economy of the study area. Their relative importance varies, depending upon the kind of yardstick used to compare them. If they are looked at from a national viewpoint, for example, their relative efficiency in use of natural resources and amounts of net value added by each industry's output are appropriate measurements. From an inter-regional point of view, however, the total dollar value of output is important.

Since this report deals with an internal economic evaluation of a small geographic area, rather than with its position in the overall regional or national setting, major emphasis was given to determining how various industries contributed to the welfare of local residents. This was done in a number of ways - the inter-industry input-output model shown in Table 34, an analysis of local business generating capacity of various basic income sources as shown in Table 37, and a graphic presentation of the origin of commercial activity in Figure 12. Each of these show different aspects of the local economy, all of which are meaningful to the overall analysis.

Table 34 provides the most comprehensive view of the relative size of the various components of the local economy as measured in terms of total dollar value of output. It also provides an overall analysis of the various inter-industry transactions involved within the economy and the proportion of activity involved in transactions with buyers and sellers located outside of the study area.

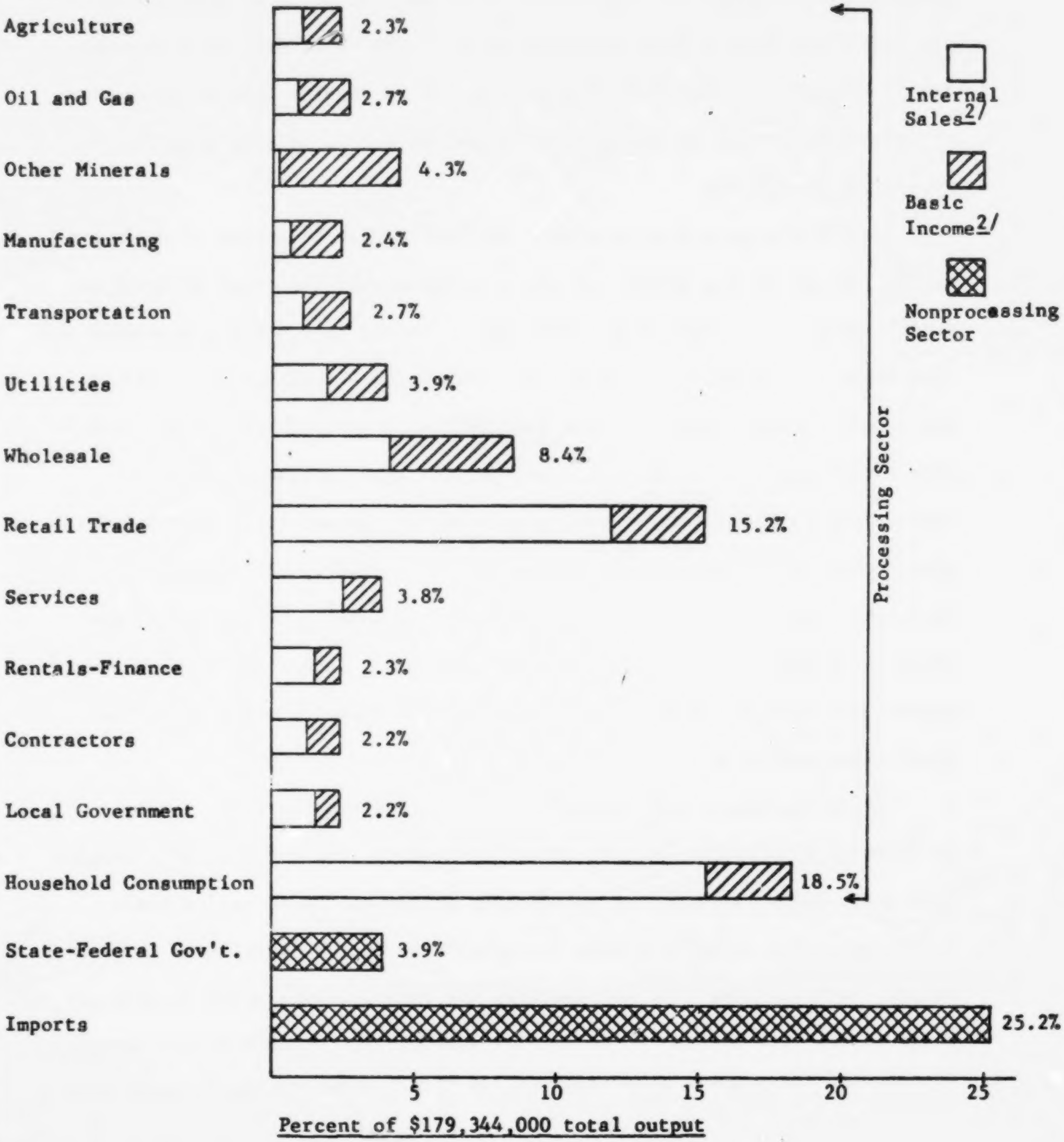
Sixteen major components of the local economy were identified as contributing in various ways to a total 1960 output valued at $179,344,000, and in the generation of a total household consumption figure of $33,092,000.

How do the various industry components compare within this framework? The relative magnitude of each component's contribution to total output is shown graphically in Figure 14. Approximately 71 percent of total economic activity took place within the processing sector. The remainder was accounted for by direct state and Federal activity, and by imports, but these are not of immediate concern to an analysis of how various industries contributed to the local economy.

Household consumption accounted for the largest component of activity within the processing sector, it had 18.4 percent of the total activity in dollar terms. This was closely followed by retail trades which accounted for 15.2 percent. Three of the four basic industries - agriculture, minerals, and manufacturing - accounted for 11.7 percent. Although it is not decernable from Figure 14, it was estimated earlier that recreation, the other basic industry in the study area, accounted for approximately $4,095,000 in gross sales or 2.3 percent of total activity. The four basic industries, therefore, were responsible for 14.0 percent of total activity but as was shown by an analysis of their contribution to basic income and other business generating capacity, these industries assumed a more important role than their contribution to total output would indicate.

The proportion of each industry's output resulting in basic income is shown also in Figure 14. It should be readily apparent from this diagram that basic income sources are not limited solely to the so-called basic industries--each industry within the processing sector contributed to some degree. Retail trades and wholesaling, for example, were major sources of basic income from within the commercial sector. The Other Minerals category contributed the highest proportion of its total output to basic income with

Figure 14. Contribution to total dollar value of output by various sectors of the economy, Animas-La Plata study area, 1960[1]



[1] Data limited to San Juan and La Plata counties, Colorado
[2] Identified for processing sector only
Source: Estimates by the authors

97.3 percent falling within this classification. Other high producers of basic income per dollar of output were agriculture, oil and gas, and manufacturing.

Three comparisions of the various components in the local economy, in terms of their relative importance, are possible on the basis of the information contained in Figure 14. These are: 1) Contribution to total economic activity; 2) Contribution to production of basic income, and 3) Proportion of each component's total output resulting in basic income.

The Household component ranks first when the various components are ranked in terms of their share of total economic activity. This component is followed in turn by Retail Trades, Wholesaling, Other Minerals, Utilities and Service. Only one of the so-called basic industry components falls within the top six when ranked in this manner.

The Wholesale component ranked first (15.2 percent), when the various industry components are ranked according to their contribution to total basic income produced. Wholesaling was followed closely by the Other Minerals category with 14.9 percent, and then followed in order of magnitude, by Households, Retail Trades, Utilities, and Oil-Gas.

Other Minerals ranked first when the components are ranked in terms of the proportion of their total output resulting in basic income. Following in order of importance are Manufacturing, 72.3 percent; the Oil-Gas segment with 69.3 percent; Transportation, 61.6 percent; Agriculture, 57.3 percent; and Wholesale Trades, 51.0 percent. The basic industries account for the first two ranks when this classification is used.

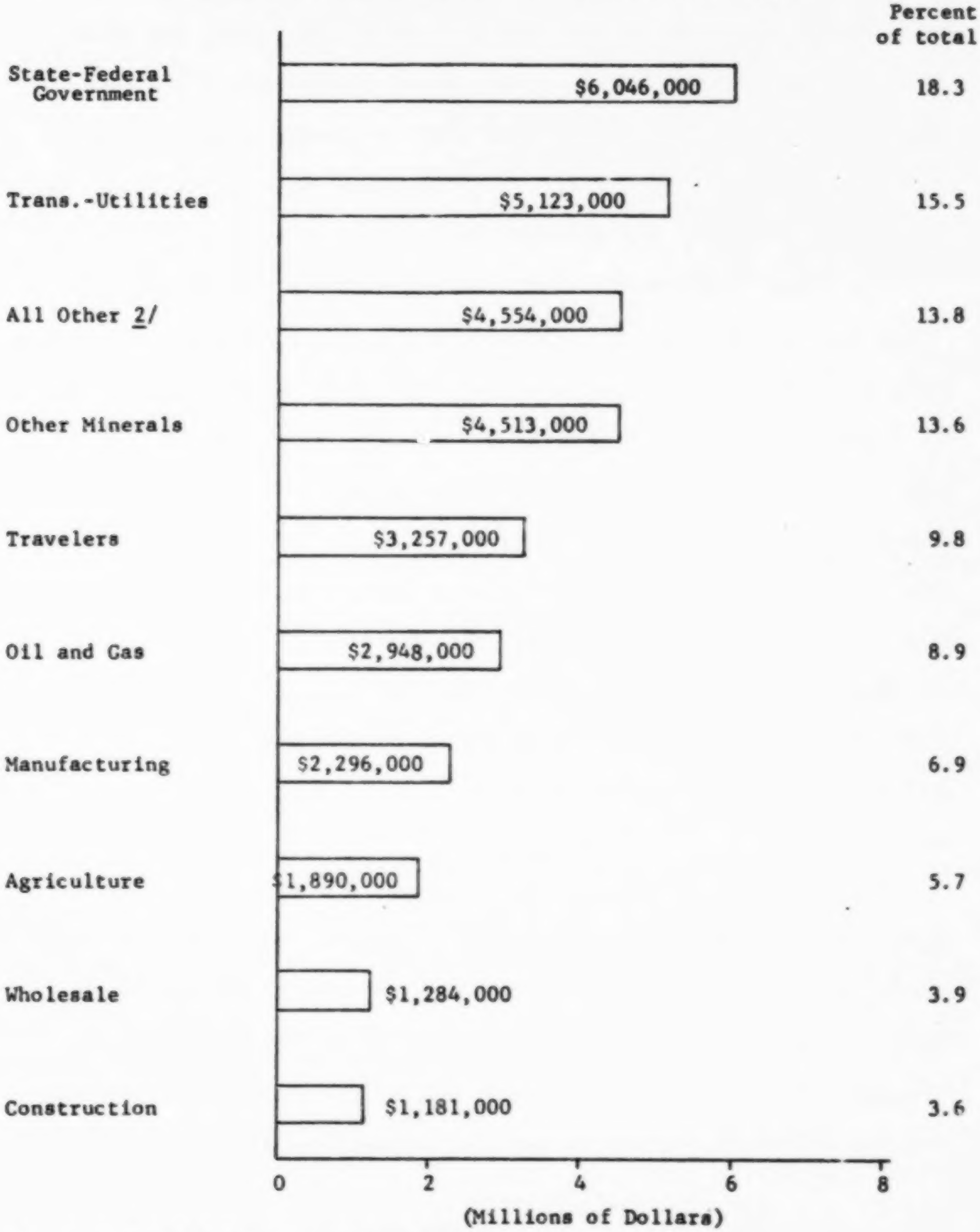
Other things are important to income production by various industries in addition to the three factors discussed above. Their respective business generating capacity, for example, must be considered (Table 37). The overall business generator for the local economy amounted to $.87. The various industries included had the following business generating capacities per dollar of basic income produced: Agriculture, $1.36; Manufacturing, $1.28; State and Federal Government Revenue, $1.19; Transporation-Utilities, $1.13; and Travelers, $.79. The Wholesale component ranked lowest with only $.30 of additional business generated per dollar of basic income produced. Again, the so-called basic industries account for the top positions.

Since commercial "industries" accounted for over a third of total economic activity, an analysis was made of the origin of basic income supporting these components (Figure 12). This diagram illustrates, for example, that the All Minerals category accounted for the highest proportion of total basic income produced, 21.5 percent, (if we ignore the "All Other" category). This component was followed in order of importance by Travelers: 15.1 percent, Transportation-Utilities: 12.8 percent; and State-Federal Government activity: 10.6 percent.

Although individual commercial components were dependent upon various sources of basic income in varying amounts, the overall dependence of the commercial sectors can be ascertained. They depended upon basic income sources in the following order of importance: All Minerals, 23.3 percent; Transportation-Utilities, 15.8 percent, and Travelers, 14.2 percent. The remaining 31.7 percent came from basic income generated by Manufacturing, Agriculture, and Construction, 20.3 percent and the "All Other" category, 11.4 percent.

A final measure of importance of the various industries can be used if their relative contribution to total realized personal income is determined. Figure 15 illustrates such a comparison. The three most important segments,

Figure 15. Realized Personal Income Attributable to Various Sources of Basic Income, Animas-LaPlata Study Area, 1960. 1/



1/ Data limited to San Juan and LaPlata Counties, Colorado
2/ Includes rentals, finance and miscellaneous sources.

Source: Estimates by the authors.

in order of importance, (if the miscellaneous segment is ignored), were State-Federal Government activity, Transportation-Utilities, and Other Minerals. These three segments accounted for almost half of the total realized personal income in the study area. Following these three major producers, in order of importance, were Travelers, Oil-Gas, Manufacturing, Agriculture, Wholesale and Construction.

The foregoing discussion should clearly indicate that no one industry within the local economy can be considered the most important. The ranking depends entirely upon the criteria used. It was shown, for example, that the export of minerals and agricultural products, sales made to out-of-area travelers, and purchases and payments by state and Federal governments were the major contributors to total basic income. It was further shown, however, that the value of basic income produced by a given industry component does not completely determine the magnitude of economic activity and the subsequent generation of realized personal income resulting from it. In the final analysis, it is the manner in which this new money moves through the secondary sectors of the economy that becomes the major determinant.

Gross regional product has been estimated for the study area as an additional important measure of the area's economic magnitude. The study area's gross regional product for 1960 was estimated to be $38.2 million. (Table 38) Gross product per capita amounted to $1,905. This compares favorably with the United States gross product per capita of $2,797 for the same year and to $2,595 for the State of Colorado for 1957 (in 1959 dollars). 1/

1/ ORRRC, Study Report No. 23, op cit.

PART IV

PROJECTION OF THE PROBABLE ECONOMIC GROWTH PATH, 1960 - 2010

Although projection theory and practice inherent in economic base studies are still crude and beset with numerous limitations, the data developed in this report will need to be assumed reasonably precise for the purpose of formulating a water quality management program for the Animas-LaPlata study area. It is necessary, therefore, to emphasize again that these appearances of precision were designed solely for planning purposes and are not to be interpreted as reliable indicators of short-run situations.

The degree of error likely to be associated with economic projections is great enough in the case of national and state projections; in the case of the two-county Animas-LaPlata study area, a much greater degree of error can be anticipated. Degree of accuracy in the projections is also related to the projection time period. The 1965 projections therefore are likely to be more reliable than the 1980 and 2010 data; the longer range projections should be viewed only in terms of general orders of magnitude.

It can generally be assumed that the more detailed projections such as industry breakdowns and labor force by type of employment are likely to be less "accurate" than such aggregate projections as total regional output and realized personal income. Reliability will likewise vary from one industry to another. In the case of manufacturing, for example, the projections are based on the assumption that technological development will proceed at a rapid enough rate to allow for the mushrooming of a major chemical industry in the study area shortly after 1980--but any number of circumstances may occur to prevent this from happening. When the agricultural industry is considered, however, its development pattern is more clear cut. Its projected future expansion is tied closely to the Bureau of Reclamation plan for development of additonal water supplies and this planning effort is already in the feasibility report stage.

Basis for the Forecast

Projections - also called forecasts, predictions and prophecies - are reasoned conclusions about the future direction and magnitude of economic activity in a given study universe. They are based on analyses of relevant past data and modified as required by objective estimates of the probable effects of new technological and sociological developments. The basis for using projections or forecasts in planning for water resource management rests on the premise that if these are derived by rigid logical analysis, they certainly provide a sounder basis for formulation and evaluation of long-range development projects than the acceptance of more contemporary and arbitrarily extrapolated conditions. It has been clearly shown by history that only in extremely rare instances can the assumption of static current rates of development be used as a basis for long-range forecasting. For this reason, the projections contained in this report will bear little resemblance to familiar present conditions.

The forecasts which follow were formulated in accordance with three basic axioms of projection theory. These are:

1. A long-term projection is fundamentally an estimate of probabilities, (in light of past trends), selection of major guiding forces, and identification of probable future modifying conditions.

2. Future conditions will probably bear some relation (but not necessarily resemblance) to those in the past and present, and circumstances or limits that will modify future conditions can be identified.
3. Some order among the variability of economic activity can be identified or assumed.

Within the above guidelines, all major parameters used in developing the projections were related to the resource base of the study area and to the nationwide market area of the population it serves.

The Forecasting Model

Every modern local economy takes part in transactions with the outside (regional and/or national) economy which bring in "new money" or basic income. The Animas-LaPlata study area is certainly no exception as explained in Part III of this report. It was shown that overall economic activity is generated as a result of these basic activities and the consequential movement of this new money through the various industrial components.

The problem of forecasting becomes somewhat more simplified through the use of this analogy because changes in basic activities are usually much more easily determined than overall activity. Overall activity can then be determined from the forecasted basic activities. In Part III the relationship of basic income to generated secondary activity and realized personal income was examined. This "exercise" in cause and effect in economic mobility can now be put to practical use in forecasting the future economic structure of the study area.

One major difficulty in applying the input-output concept to projection of future conditions presents itself. In viewing the present (1960) economy in input-output terms, an assumption was made that interrelationships between different industries do not change significantly over time. Yet, it is known that changes in purchasing or expenditure patterns within given industries is a major cause of change in total economic activity in an identified economy. In theory, this constraint would not allow use of the input-output technique for forecasting future economic development. In practice, however, this limitation was overcome in projecting to 1965 by creating a new "export" column and applying the 1960 coefficients to it, on the assumption that industry purchasing and selling patterns do not change significantly in the short-run within the internal local economy.

Mr. Richard Lund tested the validity of the above assumption in the case of a four-county southwestern Wyoming study area by estimating what the level of output should have been in 1959 by use of a 1953 model along with 1959 exports. In reporting on his findings, he states in part: "...the use of the 1953 output model along with 1959 exports provided quite reasonable indications of the actual level of output to be expected in 1959. For example, the use of the 1953 model and 1959 exports indicated that total output should have risen by 28.4 percent during this period, while it actually increased about 23.3 percent. Similarly, an increase of 42.9 percent in commercial activity was expected as compared to an actual increase of 37.1 percent." 1/

He states further: "The overall implication here is that it has been shown that the relationships existing between basic income producing activities

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1/ Richard E. Lund, An Analysis of a Local Economy in a Period of Rapid Transition, Southwestern Wyoming, (Draft for Criticism and Review) Division of Business and Economic Research, College of Commerce and Industry, University of Wyoming, Laramie, Wyoming, June 1962, p. 75.

and resulting local economic activity can be determined, and that *these relationships change very little over time even though the export picture may change drastically*. Many of the internal changes in relationships which do occur over time are associated with the household sector and consequently can easily be determined or forecasted by noting changes in the national economy and relating them to the local economy."[1]

In developing projections for 1980 and 2010, it was necessary to develop new generators for both secondary activity and realized personal income in addition to the development of new "export" components for each industry. Admittedly, these were developed on the basis of judgment but this is no more damaging to the results than developing projections for the overall economy on a judgment basis as is carried out in more conventional forecasting methods.[2] After estimates of the export component of each industry were developed, matrix multiplication provided the estimates of total economic activity.

Basic Income and Employment Changes

The new export component used in developing forecasts for 1965, 1980 and 2010 was aggregated from expected changes in each of the major industries of the local study area. Three major causes of change in these industries were given primary consideration in this evaluation: 1) Changes in price relationships; 2) Changes in production; and 3) Changes in expenditure and purchasing patterns, especially in the household component.

The affects of price changes assumed considerable importance in this analysis, particularly since the projections are stated in terms of 1960 price levels. The entire post-war period has been marked by a slow but persistent upward movement of prices and this trend is expected to continue throughout the 50-year projection period. From 1955 to 1960, the consumer price index climbed 10.4 percent while the non-farm commodity wholesale price index rose 9.7 percent. During this same period wages and salary per person increased 11.3 percent. These overall trends were taken to be indicitive of expected changes during the next 5 years and with modification similar estimates of expected change were developed for the 1980 and 2010 situations.

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[1] Lund, op. cit., p. 100.

[2] For a discussion of how errors in judgment may affect the results of the model, refer to Appendix B, "A Discussion of Errors Affecting the Model."

Estimates of changes in production and expenditure-purchase patterns were not developed in so clear-cut a manner as expected changes in prices. These are responsive to a number of interdependent and simultaneously changing factors. Among the factors taken into consideration were technology, population movement, long range national goals, and the like. Rather than spelling out the explicit assumptions made in regard to these factors, it is deemed more desirable to indicate the expected affects on the economy--industry by industry. These are discussed in turn below:

Agriculture

The agricultural industry is not likely to change significantly by 1965. The cost-price squeeze on producers is likely to continue but will likely be offset to a considerable degree by more efficient production practices. Since output per man is expected to increase, while the land base is declining slightly, a continuing decline in the number of farm workers is expected.

Commencing with 1965, however, a rapid expansion in the agricultural industry is expected which will continue to about 1980 when a peak in the number of agricultural employees is anticipated. The first units of the Florida component of the Bureau of Reclamation water supply project are expected to be put into operation by 1965 and by 1980 all units in the

Animas-LaPlata project are expected to be in use. Total output in both product and monetary terms is expected to rise throughout the projection time period but after 1980 a decline in both basic income (sale of agricultural products outside of the study area) and farm employment is anticipated (Figure 16).

The projected decline in basic income produced by agriculture is not to be confused with total agricultural production which is expected to increase throughout the projection time period. The decline in the basic income component of agricultural output is related to expected changes in other sectors of the local economy. First, a greater share of agricultural output will be consumed locally as rapid population expansion occurs in the area during the 1980-2010 period. Second, as manufacturing activity expands, more of the local agricultural output will be marketed via the local food processing plant rather than by direct shipment to a plant in Denver or other urban center outside of the study area.

The expected decline in farm workers after 1980 is likewise related to a number of factors. First, no new irrigated lands are expected to be brought into use after completion of the Animas-LaPlata Project and as other sectors of the economy expand they will begin to encroach on the land base that is now available and/or which will be brought into use during the 1965-1980 period (Figure 17). Second, as efficiency per worker increases, a smaller work force will be able to operate this given land resource base. The ratio of labor efficiency, for example, compared to 1960, is expected to rise to 1.32 in 1965, 1.66 in 1980 and to 2.33 by 2010.

Minerals

An increase of approximatley 30 percent in output in the mineral

Figure 16 - Projected Basic Income and Employment Changes in the Agricultural Industry, Animas-La Plata Study Area, 1965, 1980, and 2010 Compared to 1960.

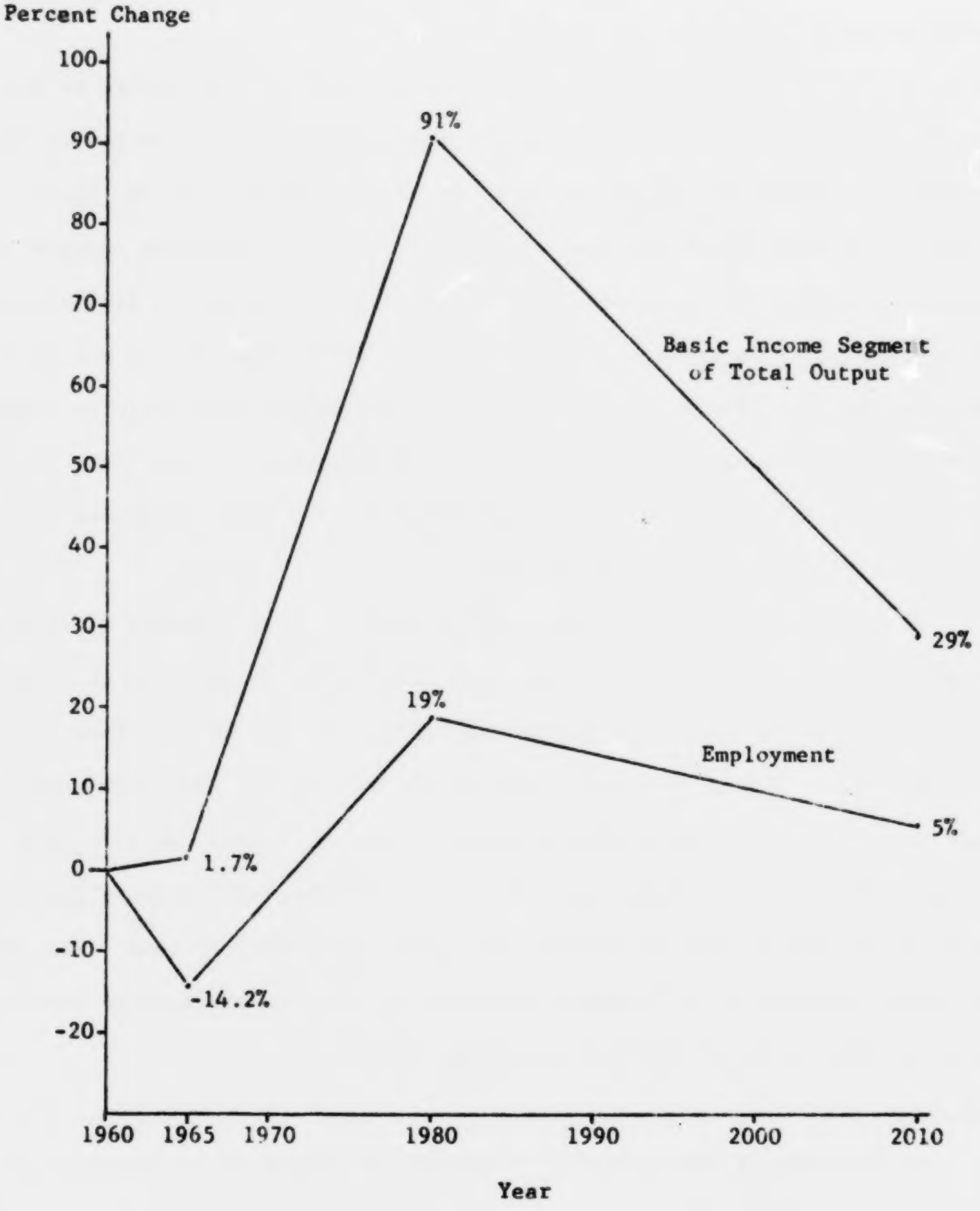
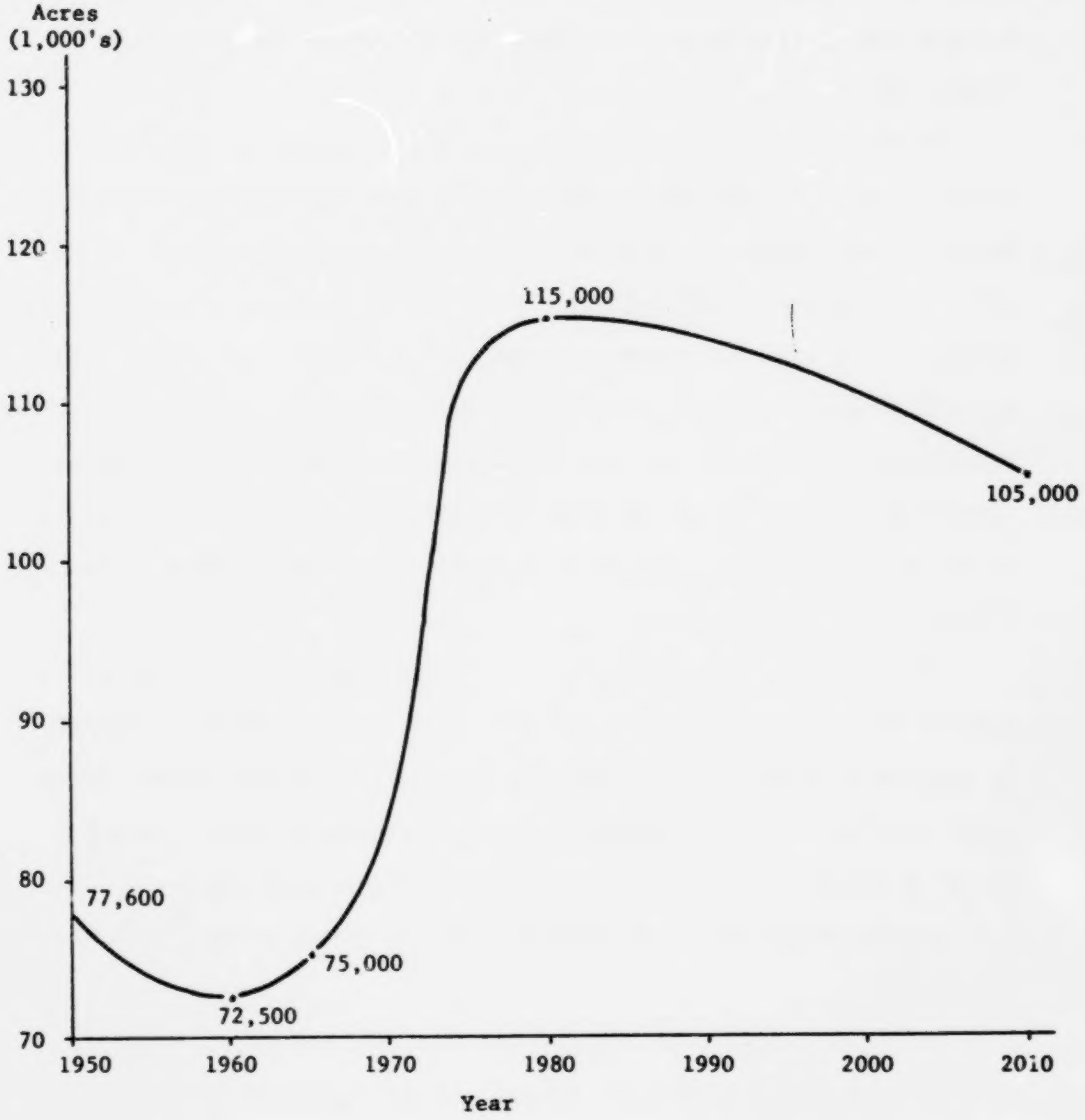


Figure 17 - Acres Irrigated, Animas-La Plata Study Area, 1950, 1960, and Projections for 1965, 1980, and 2010



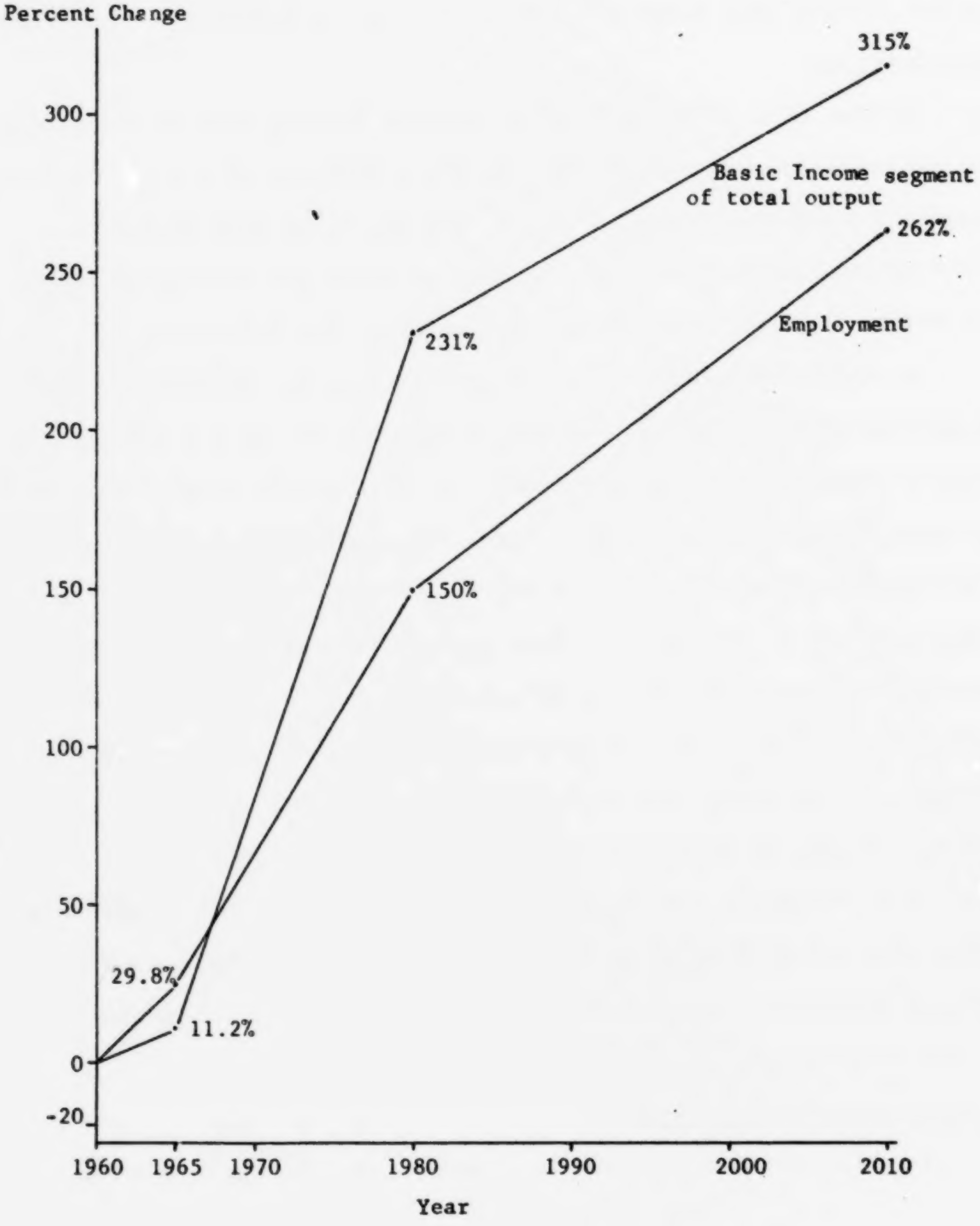
industries is expected by 1965 followed by an even more rapid increase from 1965 to 2010. Unlike expectations for the agricultural industry, both the basic income component of total output and labor force employed in minerals are expected to rise sharply throughout the 50-year projection period (Figure 18).

Increases in output and production to 1965 will be accounted for primarily by the oil and gas segment although expansion and renovation of a number of metal mines in the area will contribute significantly to total labor force employed. Oil and gas will continue to account for a significant portion of the expected expansion of the mineral industry from 1965 to 1980 but will probably level off from 1980 to 2010 as the vast oil reserves in the Four Corners area are brought under a more or less sustained yield operation. Toward the later phase of the 1965-1980 period, an acceleration of activity in the production of coal and other minerals serving as raw material for the chemical industry is expected.

Although the basic income component of the mineral industry output is expected to increase throughout the 50-year period, a slowdown in the rate of increase is expected after 1980. During the 1980 to 2010 period, total output is expected to rise sharply but the percentage of total output exported is expected to decline. This relationship is expected because of an assumed rapid expansion of the chemical industry in the study area during this period.

Increases in efficiency as reflected in output per worker are expected to increase at a slower rate for the oil and gas segment than for the other segments in the local mineral industry. For oil and gas the expected ratios, compared to 1960, are: 1.02 for 1965, 1.23 for 1980 and 1.49 by 2010. For

Figure 18 - Projected Basic Income and Employment Changes in the Mineral Industry, Animas-La Plata Study Area, 1965, 1980, and 2010 Compared to 1960.



"all other" minerals expected increases are: 1.05 for 1965, 1.80 for 1980 and 2.0 by 2010. The relatively slow rate of increase in the oil and gas segment is due to the fact that a major share of the workers in this category will be administrative in nature and therefore the real rate of increase in efficiency in the oil and gas industry as a whole is not reflected.

Manufacturing

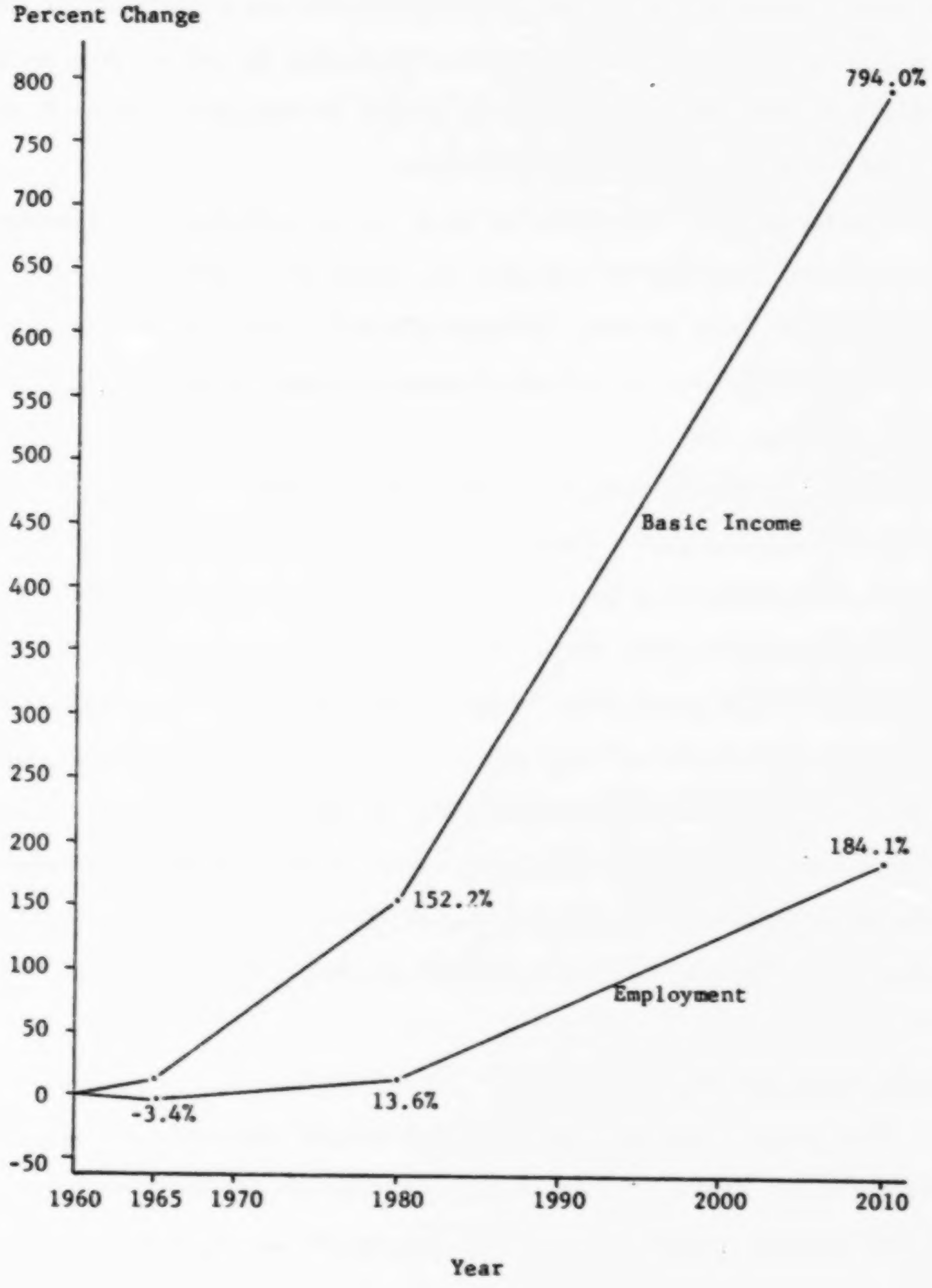
Manufacturing is not expected to assume a dominant role in the economy of the study area until after 1980 when rapid expansion of a major chemical industry is expected. Total output is expected to increase slightly to 1965 but because of increasing efficiency in output per worker, the number of workers employed is expected to decline by about 3.5 percent.

During the 1965-2010 period both the basic income component of total output and number of workers employed is expected to rise with the highest rate of increase occurring in the basic income component (Figure 19). Employment is expected to increase at less than one percent per year until 1980 but to increase at a relatively moderate rate during the following projection period as the chemical industry moves into full operation. Basic income from exports is likewise expected to increase at a faster rate after 1980 because of the nature of the product to be produced--relatively small amounts will be needed for local consumption. Labor efficiency rates associated with the manufacturing industry are expected to rise to 1.22 of the 1960 rate by 1965, to 2.20 by 1980 and to 2.76 by 2010. Such increases in efficiency are still below the "high" projections for the nation but are nonetheless considerably higher than rates projected for most of the other segments of the local economy.

Transportation and Utilities

Expected increases in transportation and utilities are tied closely to

Figure 19 - Projected Basic Income and Employment Changes in the Manufacturing Industry, Animas-La Plata Study Area, 1965, 1980, and 2010 Compared to 1960



projected changes in mineral, manufacturing and recreational activities. Projected changes in basic income from transportation and utilities and the labor force involved, relative to 1960, are shown in Figure 20. Compared to the basic industries, the rates of increase shown are relatively low. This is due primarily to the rate of increase in output per man expected to occur. Compared to 1960, the efficiency rate in 1965 is expected to be 1.12, at 1.5 by 1980 and at 2.25 by 2010.

A major share of the export or basic income component of transporation and utilities is likely to come from the utilities segment in the 1960-1980 period. After 1980, however, transporation will likely account for the greater share of basic income attributable to these industries.

Wholesale Trade

Durango presently serves as a major trade center for a large portion of the Four Corners area. Since wholesaling plays a major role in providing goods to the service and retail sectors, its contribution to total basic income entering the local area is particularly significant. Due to expected increases of major proportions in both local population and certain basic industries, its importance as a producer of basic income (directly) will tend to diminish. Total output, however, is expected to increase tremendously and in spite of higher efficiency rates, total employment is likewise expected to increase to a moderate degree (Figure 21). Efficiency rates, compared to 1960 are expected to be 1.25 in 1965, 1.74 in 1980 and 1.82 in 2010.

Retail Trade and Services

Both retail trade and service activities are expected to expand rapidly throughout the 50-year projection period. They are expected to be the fastest growing segments of the local economy during the next five years.

Figure 20 - Projected Basic Income and Employment Changes in the Transportation and Utility Industries, Animas-La Plata Study Area, 1965, 1980, and 2010 Compared to 1960.

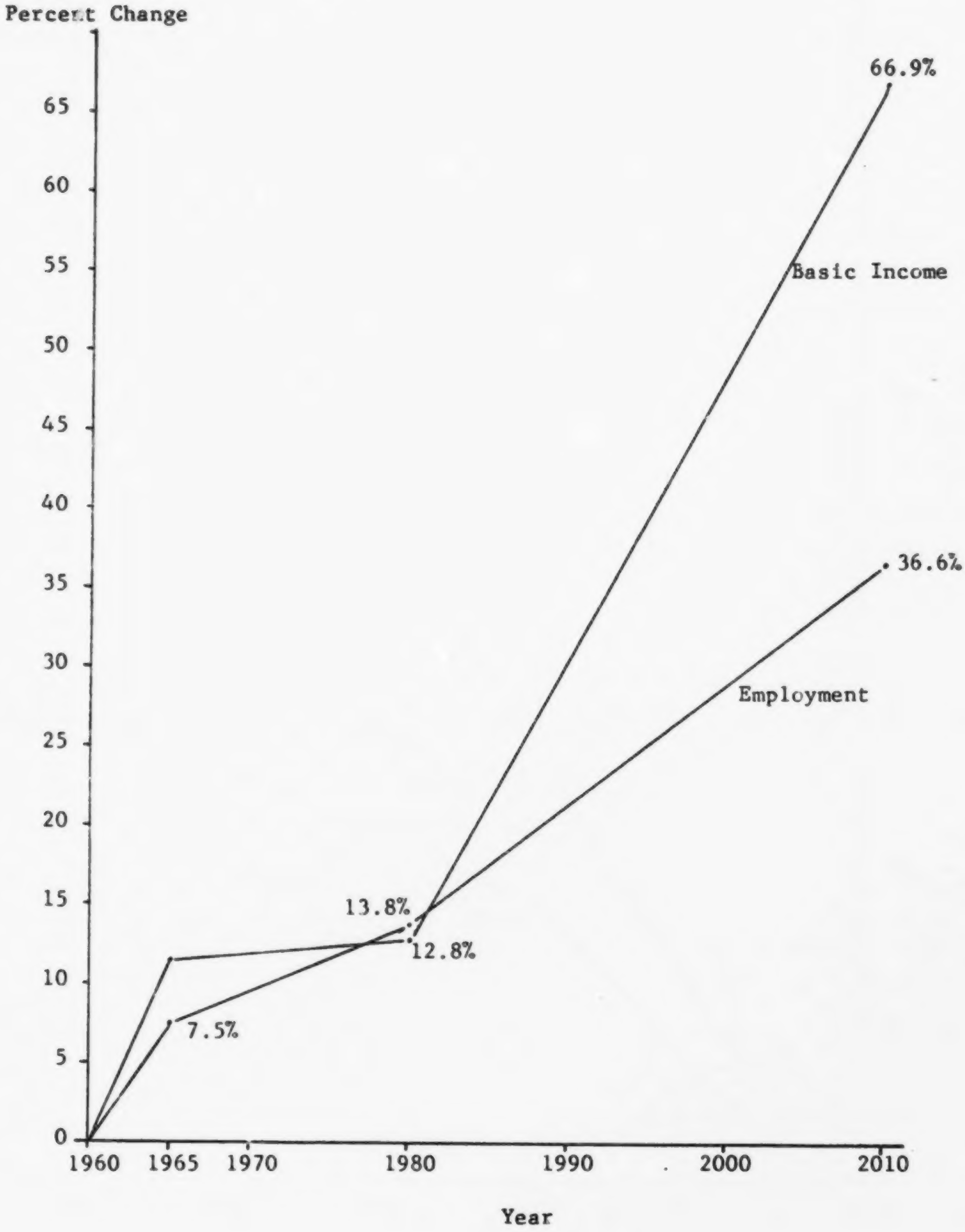
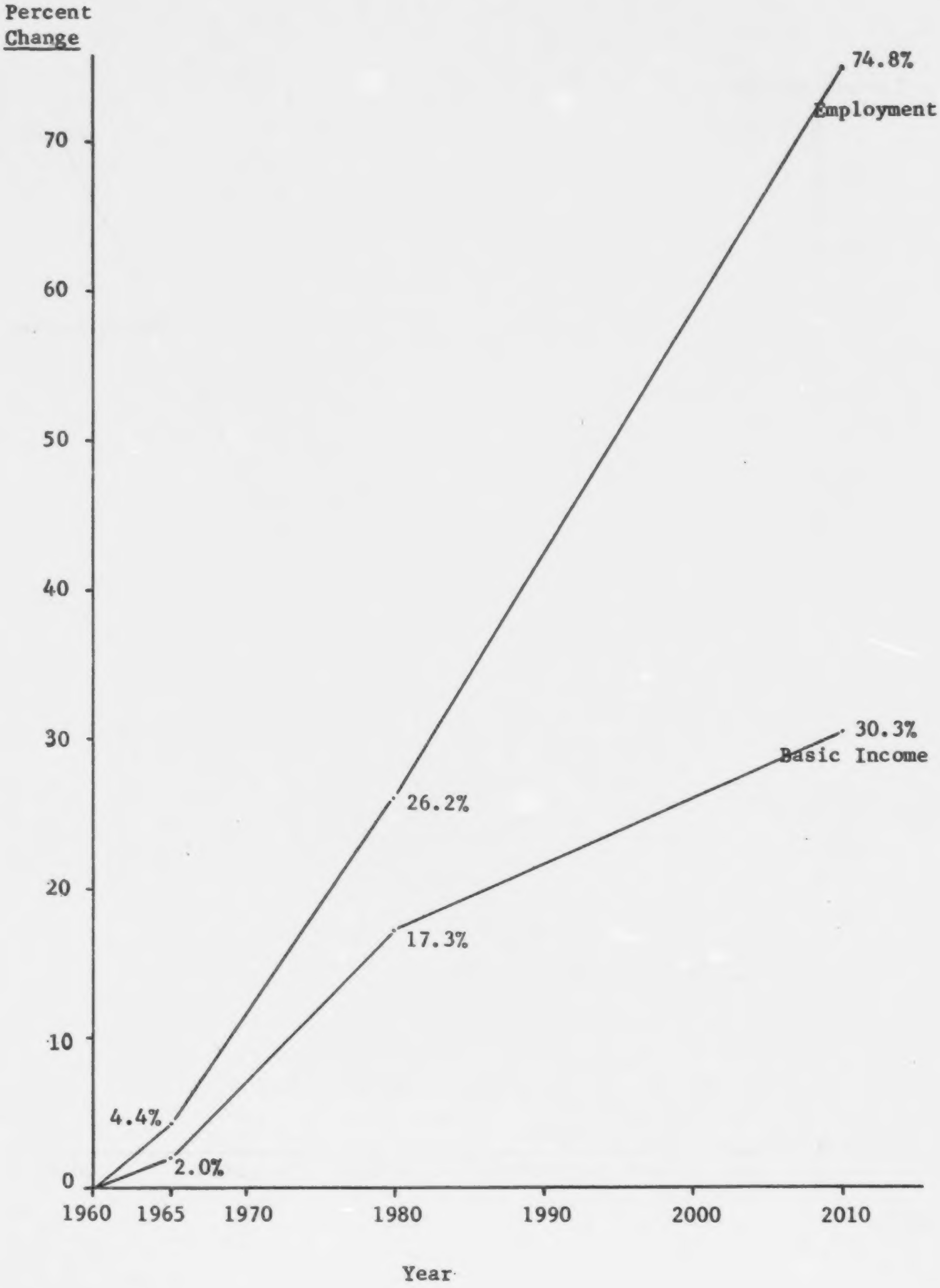


Figure 21. Projected Basic Income and Employment Changes in the Wholesale Trade Industry, Animas-LaPlata Study Area 1965, 1980 and 2010 compared to 1960



Most of the expected increase in the basic income component of these industries can be directly attributed to anticipated increases in recreation expenditures. During 1960, tourists and other traveler expenditures accounted for approximately 15 percent of the basic income component (7.6 million) of these industries' total output. If the same rate of increase occurs in this segment of total income as that projected for the Golden Circle area, it would increase to $13.7 million in 1965, to $31.6 million in 1980 and to $53.4 million by 2010 (Table 39).[1] Although efficiency rates for labor employed by these industries are expected to rise sharply, total labor force nonetheless will likely increase significantly during the projection time period (Figure 22). The rate of increase in basic income production will slow slightly after 1980 as a greater share of the industry output will be utilized locally.

Construction

The construction industry, overall, is expected to expand at a rapid rate during the 1960-1980 period during which large investments in Federal water development projects are expected. Total output in 2010 is expected to be slightly less than in 1980 although the basic income component is expected to continue to increase. Total employment, however, is expected to decline from 1980 to 2010 for two major reasons. First, a substantial decline in Federal construction is expected upon completion of the water development project and interstate highway construction and even though an increase in construction of plants for manufacturing is anticipated at or about 1980, it will not completely offset the decline. Second, a rather significant

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[1] The Golden Circle is the name applied to the outstanding concentration of scenic, archaeologic and scientific outdoor attractions in a 15 county area made up of southern Utah, northern Arizona, western Colorado and northwestern New Mexico. See reference listed on the following page for a listing of the counties involved.

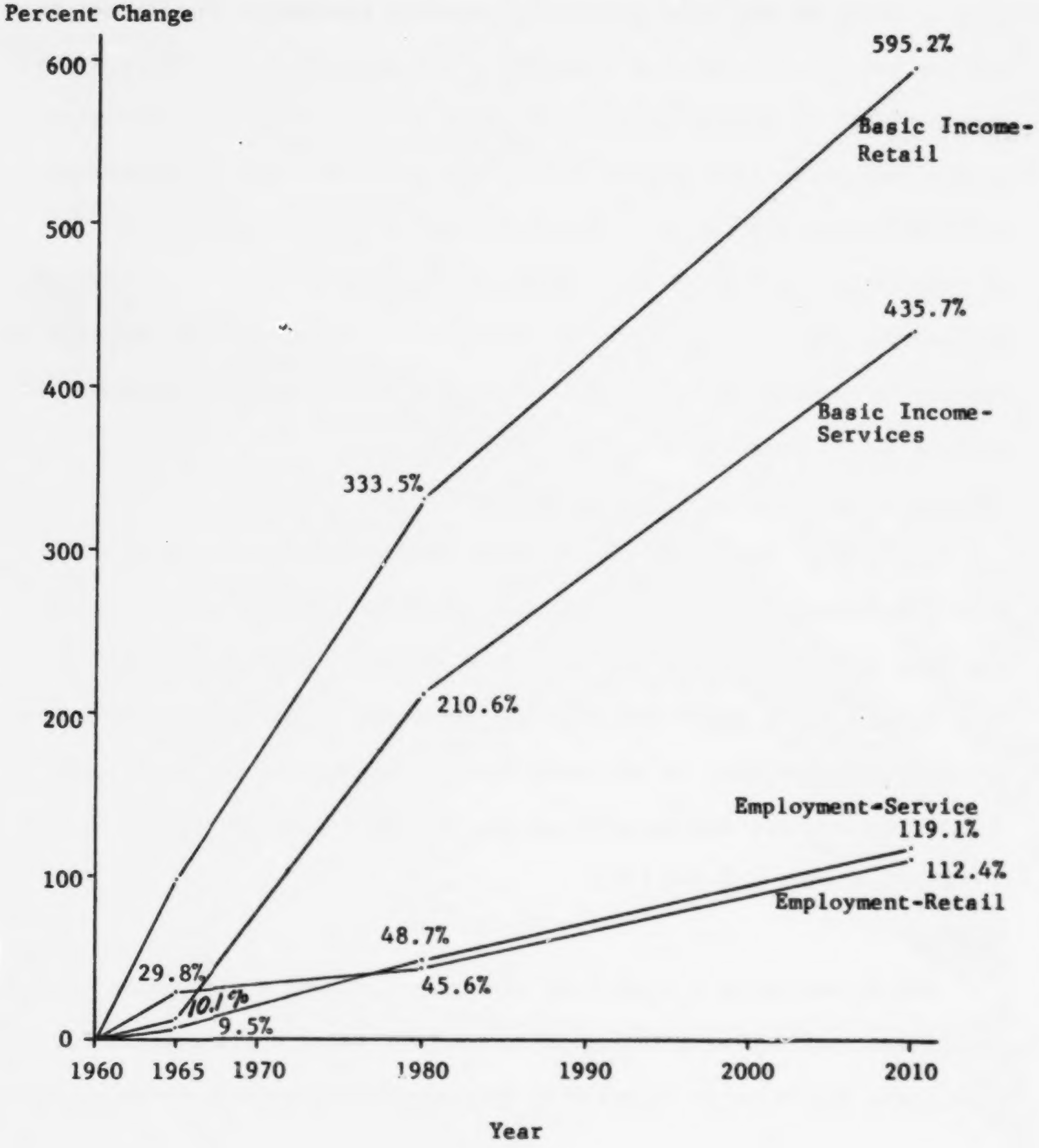
Table 39. Projection of Traveler Expenditures for Recreation in the Golden Circle Area and the Animas-LaPlata Study Area, 1960-2010. 1/

Year	Golden Circle Area ($1,000's)	Animas-LaPlata Study Area ($1,000's)	Ratio of Projected Year to 1960
1960	28,597	7,629	-
1965	50,646	13,503	1.77
1980	118,518	31,584	4.14
2010	NA	53,403	7.00

1/ Assumes the development of the proposed Canyonlands National Park with construction commencing in 1963 and first year of attendance at Glen Canyon National Recreation Area in 1966.

Source: Projections for the Animas-LaPlata area prepared by the authors; data shown for the Golden Circle Area adapted from: R.R. Edminister, O. L. Harline, et al, An Economic Study of the Proposed Canyonlands National Park and Related Recreation Resources, Prepared for the National Park Service, U. S. Department of Interior, Bureau of Business and Economic Research, College of Business, University of Utah, March 1962, Table 7.6, p. 176.

Figure 22 - Projected Basic Income and Employment Changes in the Retail Trade and Service Industries, Animas-La Plata Study Area, 1965, 1980, and 2010 compared to 1960.



increase in worker efficiency is expected, particularly in the latter part of the 50-year projection period. It is expected to rise to 1.40 in 1965 when compared with 1960, to 1.79 by 1980 and to 2.20 by 2010. Expected changes in the basic income component and employment are shown in Figure 23.

State and Federal Government Activity

A continuing increase in the contribution of state and Federal government activity to the local economy is expected throughout the 50-year projection period. The rate of increase in its contribution to basic income and in number of workers employed is expected to increase at a somewhat slower rate after 1980 (Figure 24). Part of the increase in government activity's contribution will represent added employment and payroll in connection with the Florida and Animas-LaPlata Projects of the Bureau of Reclamation and continued highway construction. Another major increase is expected to come about as a result of higher social security payments and various general welfare programs.

Changes in Other Sectors of the Economy

Many other alterations in the basic income and employment picture have been considered in developing the projected economic growth path to the year 2010 but they are too varied in nature to discuss in detail at this point. Among these were a slight reduction in the unemployment level, a significant increase in the basic income component in the retail and finance industries, modification in the sources of outside income in the household sector, and the like.

Summary

The Animas-LaPlata Study Area currently includes a wide range of economic conditions, particularly in regard to land and water utilization. Furthermore, this diversity is expected to continue throughout the 50-year projection

Figure 23 - Projected Basic Income and Employment Changes in the Construction Industry, Animas-La Plata Study Area, 1965, 1980, and 2010 compared to 1960.

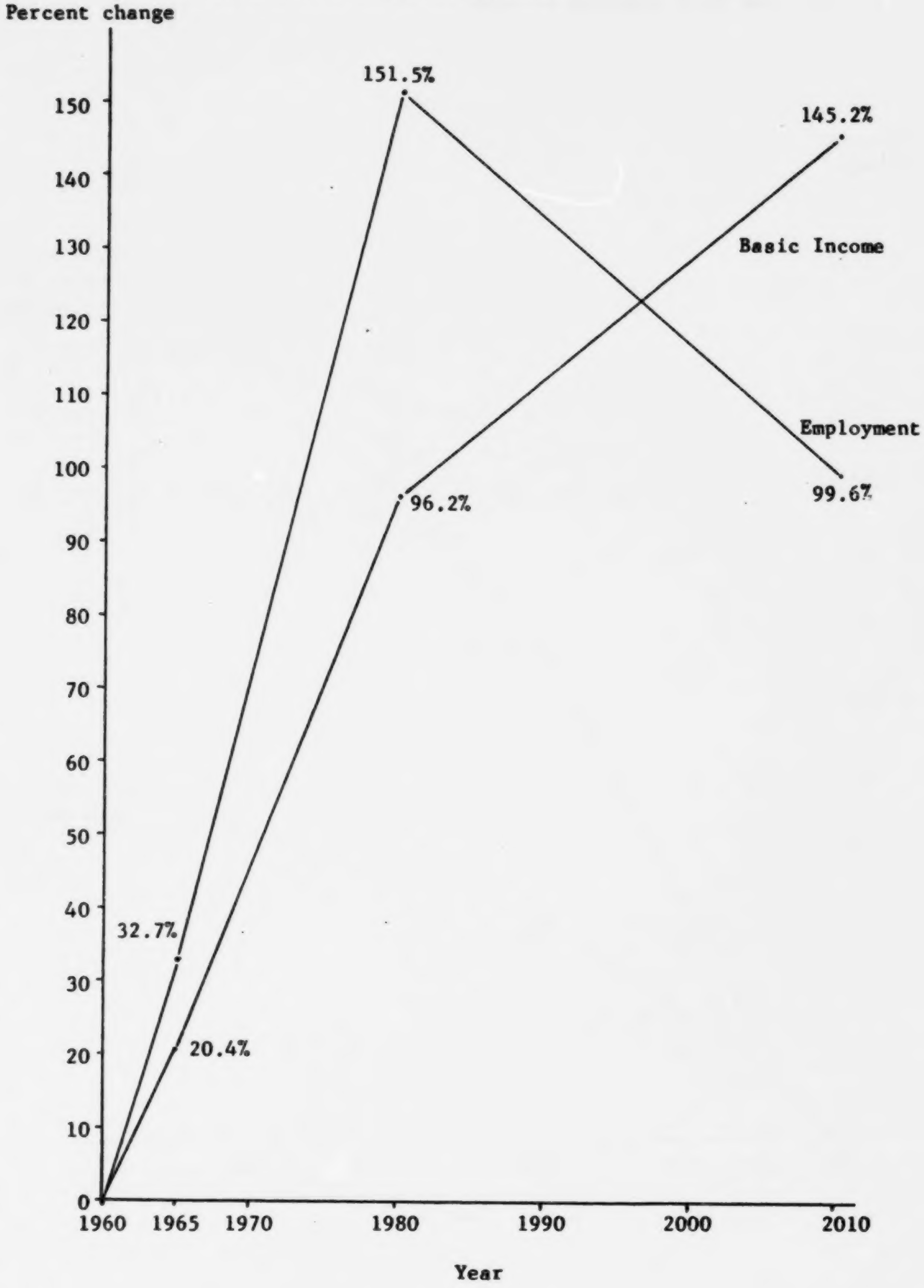
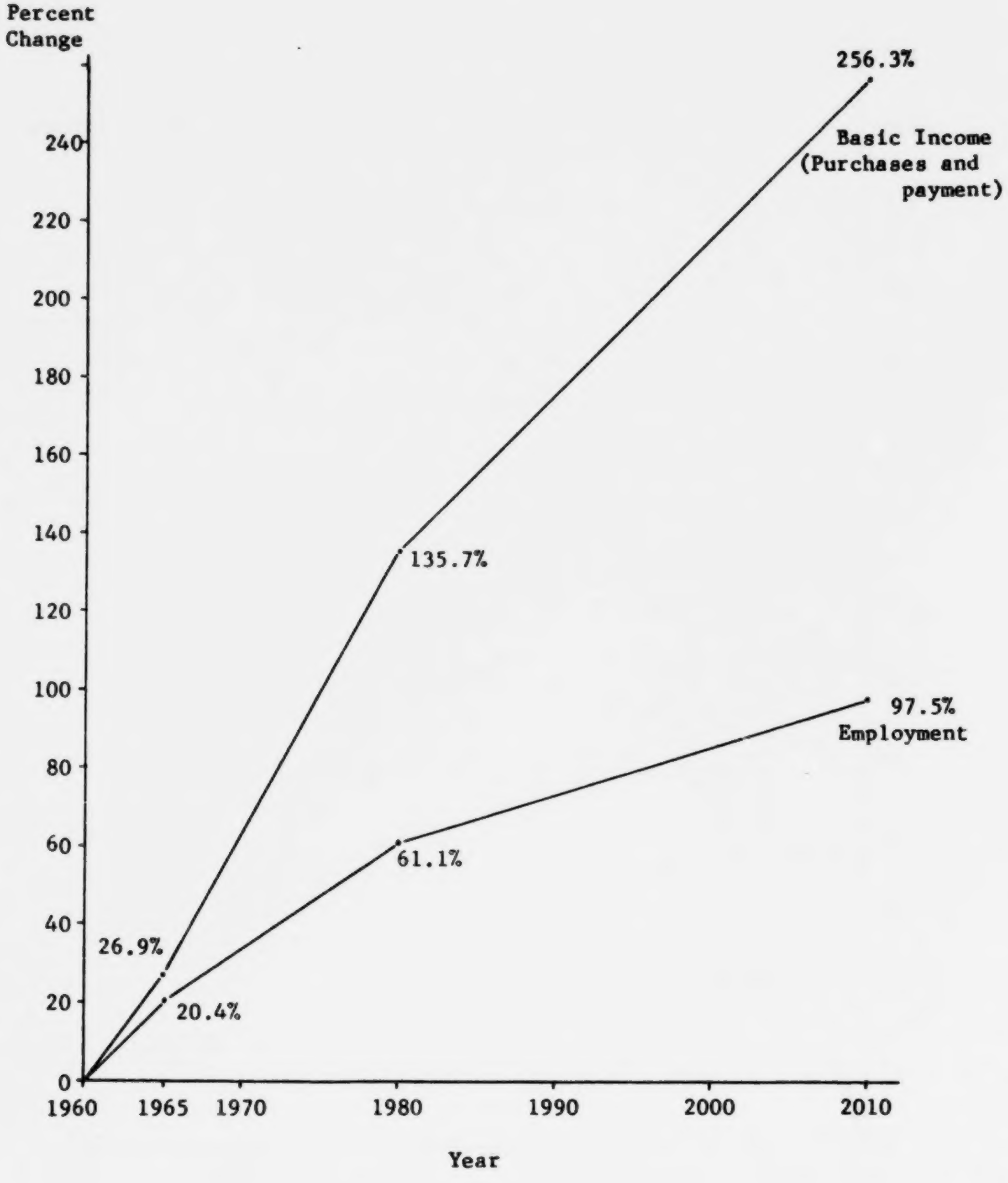


Figure 24 - Projected Basic Income and Employment Changes in Government, Animas-La Plata Study Area, 1965, 1980, and 2010 compared to 1960.



period and as a result will become a much more critical factor in planning for the optimum use of these resources. The projections contained in Section IV of this report will therefore bear little resemblence to the present situation. It is on this basis that projections based on an analysis of probable changes in the interrelationships of various industry components has been substituted for the more conventional approach based on an extrapolation of past trends.

In the foregoing section, the analysis of expected changes in the local economy was limited to a relative comparison of basic income and employment components with those in the 1960 situation. These are summarized in Table 40. A discussion of expected changes in population and labor force, in absolute numbers, follows in the next section. Finally, in the concluding section, a look at the probable future economy, along with possible variations in the expected growth path, will be presented in dollar terms.

Population and Labor Force

Population growth influences the development of a local economy because it represents the source from which its labor force is drawn and accounts for the major portion of direct purchases of the region's output. By the year 2010, population is expected to have increased to 43,000. It is expected to be 24,000 in 1965 and 32,500 in 1980. A comparison of relative population growth rates with projections for Colorado, the Mountain States Region and the United States is shown in Figure 25. The percent of the projected population expected to be in the labor force in 1980 and 2010 is about the same as the current level. In absolute numbers, the total labor force is expected to increase from a 1960 level of 7,193 persons to 8,160 in 1965, to 11,400 in 1980 and to 15,200 in 2010. Unemployment is

Table 40 Summary of Projected Changes in Basic Income, Employment, and Output per Worker, by Major Industries, Animas-La Plata Study Area, 1965, 1980 and 2010, compared with 1960.

	Percentage Change Compared to 1960 [1]		
	1965	1980	2010
AGRICULTURE			
Basic Income Component	1.7	90.6	28.8
Employment	-14.2	18.7	5.5
Output per Worker	32.0	66.0	133.0
MINERALS			
Basic Income Component	11.2	231.1	315.3
Employment	24.8	149.7	262.0
Output per Worker	4.8	59.0	90.3
MANUFACTURING			
Basic Income Component	12.6	152.2	794.0
Employment	-3.4	13.6	184.1
Output per Worker	22.0	120.0	176.0
TRANSPORTATION-UTILITIES			
Basic Income Component	11.5	12.8	66.9
Employment	7.5	13.8	36.6
Output per Worker	12.0	50.0	125.0
WHOLESALE TRADE			
Basic Income Component	2.0	17.3	30.3
Employment	4.4	26.2	74.8
Output per Worker	25.0	74.0	82.0
RETAIL TRADE			
Basic Income Component	98.9	333.5	595.2
Employment	29.8	45.6	112.4
Output per Worker	10.0	40.0	63.0
SERVICES			
Basic Income Component	10.1	210.6	435.7
Employment	9.5	48.7	119.1
Output per Worker	20.0	75.0	100.0
CONSTRUCTION (Contractors)			
Basic Income Component	20.4	96.2	145.2
Employment	32.7	151.5	99.6
Output per Worker	40.0	79.0	120.0

CONT'D

Table 40 Concluded

	Percentage Change Compared to 1960		
	1965	1980	2010
RENTALS AND FINANCE			
Basic Income Component	9.1	106.9	238.6
Employment	- 5.3	52.2	132.9
Output per Worker	27.0	74.0	125.0
GOVERNMENT			
Basic Income Component	26.9	135.7	256.3
Employment	20.4	61.1	97.5
Output per Worker	5.4	45.9	80.0
HOUSEHOLDS			
Basic Income Component	10.0	187.6	413.8
ANIMAS-LAPLATA STUDY AREA (OVERALL SUMMARY)			
Basic Income Component	21.9	149.5	286.9
Employment	13.7	60.5	114.1
Output per Worker	6.9	56.7	85.5
UNITED STATES[2]	1965	1976	2000
Employment	N.A.	40.0	110.0
Output per Worker	N.A.	47.7	77.4

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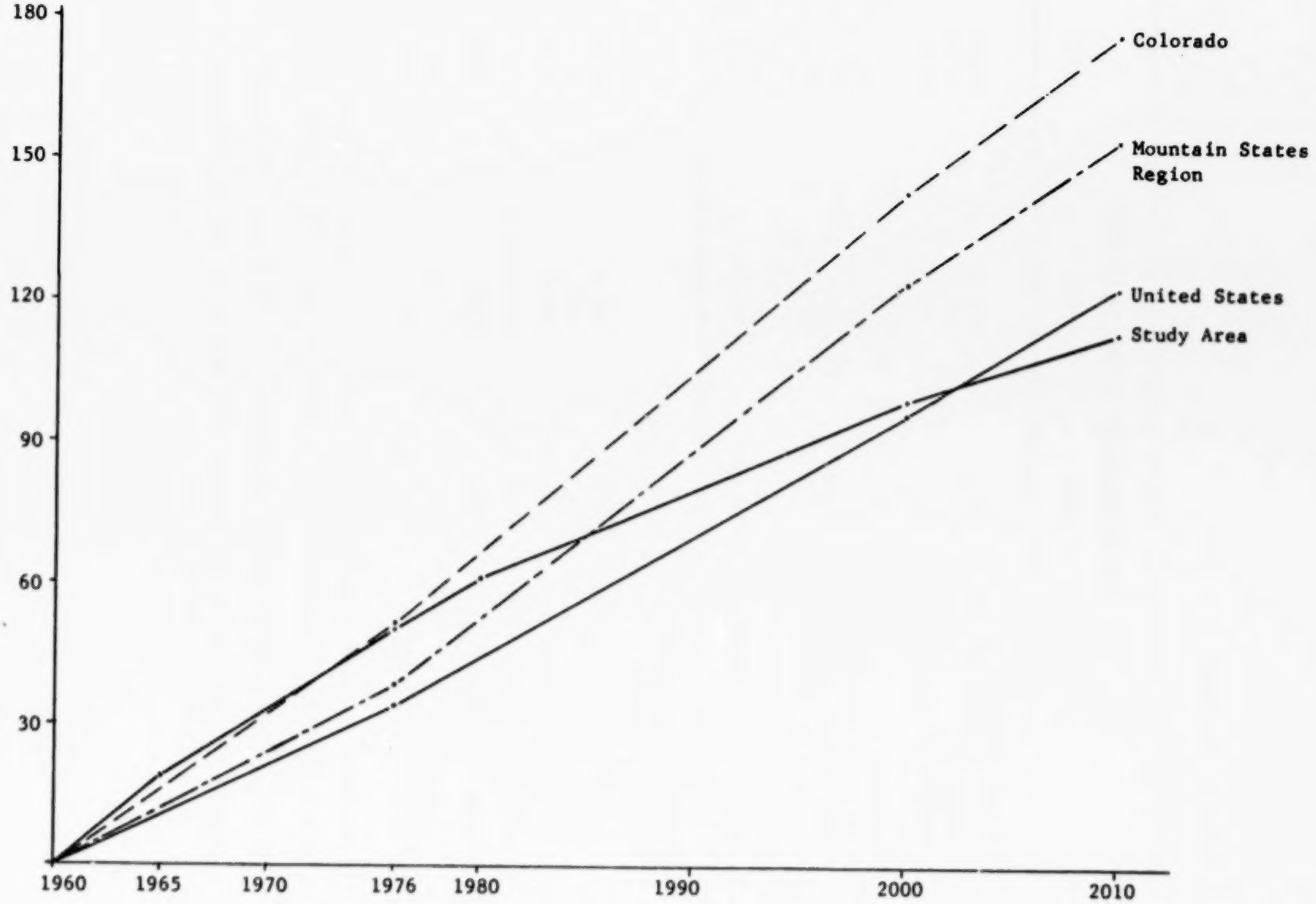
[1] All figures are positive unless a minus is specifically shown.

[2] ORRRC, Study Report No. 23, Projections to the Years 1976 and 2000, op.cit.

Source: Projections by the authors with the exception of the United States data; see footnote above.

Figure 25 - Projection of Percentage Increase in Population, Animas-La Plata Study Area Compared to Colorado, the Mountain States Region and the United States, 1960-2010.



Source: NPA projections and estimates by the authors.

expected to drop from a current level of 5.1 percent of the labor force to 3.9 percent by 1980 and to remain at the 3.9 percent level to 2010.

Population Distribution by Residence Location

The urbanization trend in the study area is expected to continue at an increasing rate during the 50-year projection period (Figure 26). The city of Durango, which is the only urban center in the Colorado portion of the study area, accounted for approximately 55 percent of the total population in 1960. A slight decline is expected to 1965, however, when Durango is expected to account for 52 percent of the total population, followed by an increase to 57 percent in 1980 and to 71 percent in 2010. The percentage of the population residing in the open country areas is expected to rise from 1960 to 1980 but decline after that as some of the more heavily settled open areas are incorporated into the Durango population center. The small town population has been decreasing since 1950 and this trend is expected to continue through 1970 after which a gradual increase is expected.

Employment

The labor force includes both employed and unemployed persons. Since some unemployment is always present, (because some persons are changing jobs, changes in demand for various skills, and the like), it was assumed that such persons will account for 4.9 percent of the labor force in 1965, and 3.9 percent in 1980 and 2010, compared with a 1960 level of 5.1 percent. These assumed rates compare with a projected rate of 4.0 percent in 1976 and 2000 for the nation as a whole. 1/

The expected change in distribution of labor force employed in various industries from 1960 to 2010 is shown in Figure 27 and in Table 41. Mining,

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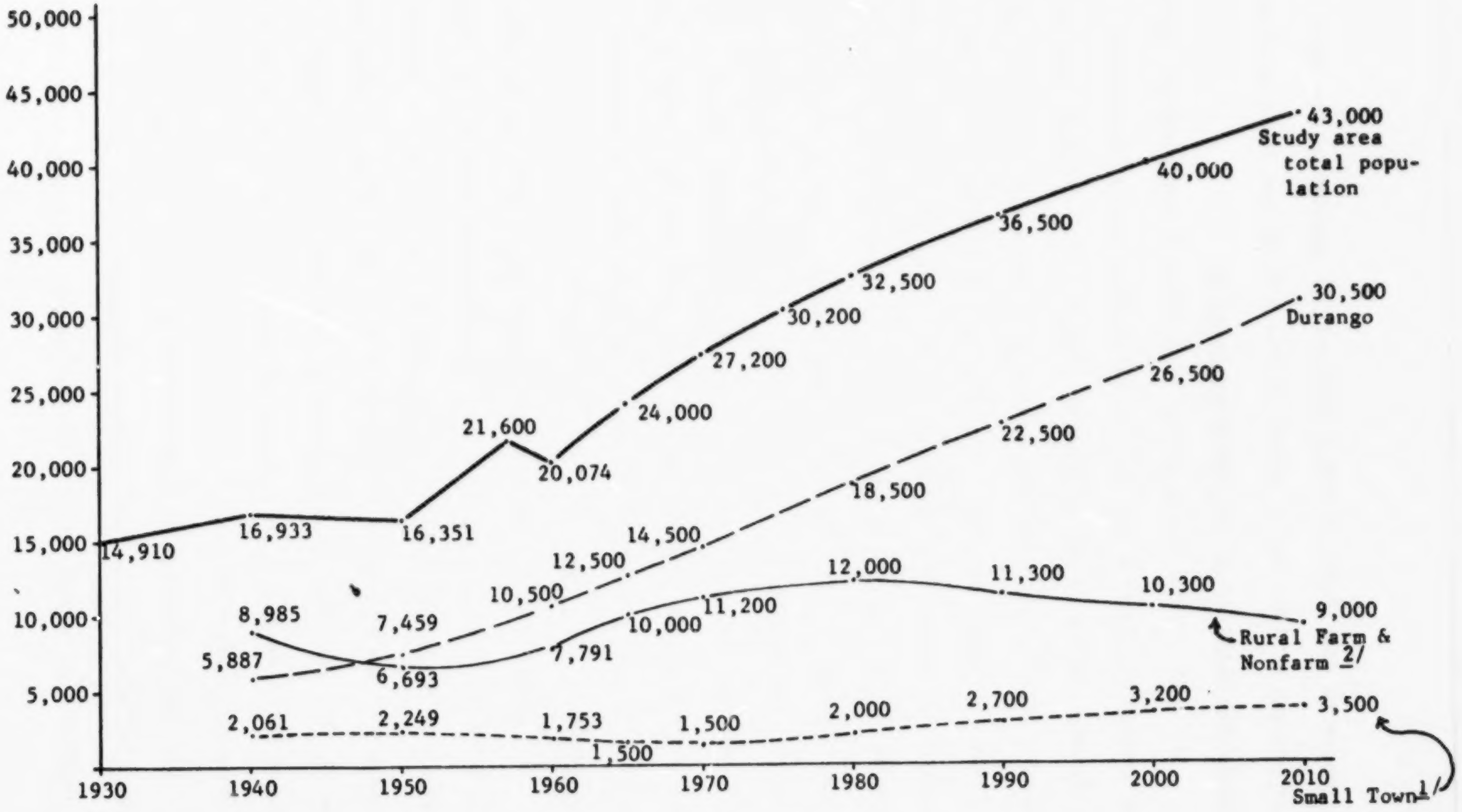
1/ ORRRC, Study Report No. 23, Projections to the Years 1976 and 2000, op cit.

Figure 26 - Population trends by Socio-Economic Orientation, Animas-La Plata Study Area, 1930 - 1960, and Projections to 2010



1/All incorporated and unincorporated places of less than 2,500 population
2/All residents in the open country

Figure 27 - Distribution of Civilian Employment by Major Industry Categories, Animas-La Plata Study Area, 1960 and Projections for 1965, 1980, and 2010

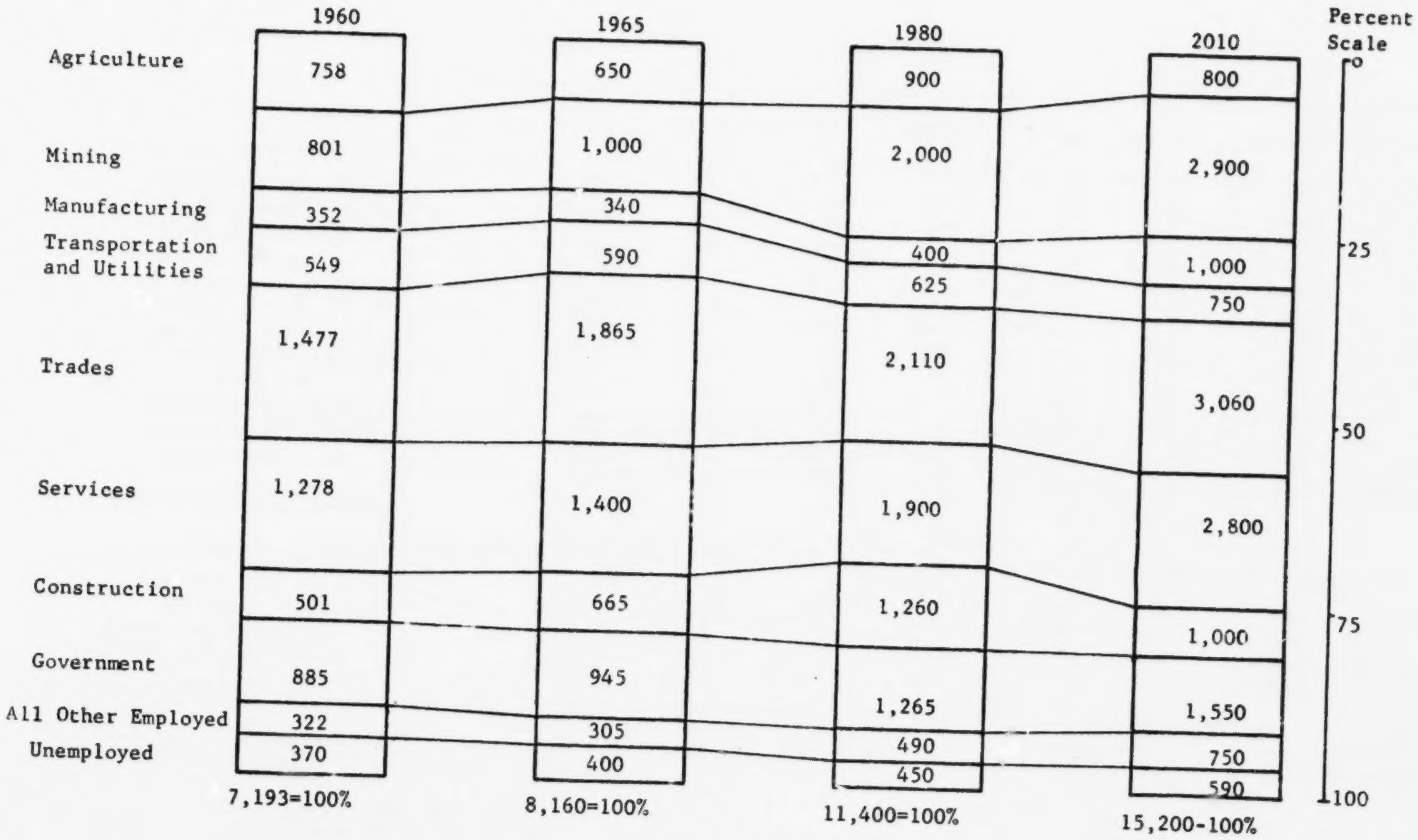


Table 41. Employment by Major Industry Divisions, Animas-LaPlata Study Area, 1960, and Projections for 1965, 1980 and 2010.

	1960		1965		1980		2010	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Total Population	20,074	**	24,000	**	32,500	**	43,000	**
Total Labor Force	7,193	100.0	8,160	100.0	11,400	100.0	15,200	100.0
Employed	6,823	94.9	7,760	95.1	10,950	96.1	14,610	96.1
Unemployed	370	5.1	400	4.9	450	3.9	590	3.9
Population-Labor Force Ratio	2.79		2.94		2.85		2.83	
Employment Distribution								
Agriculture	758	10.5	650	8.0	900	7.9	800	5.3
Minerals-Oil and Gas	230	3.3	300	3.7	750	6.6	1,200	7.9
Minerals-All Other	571	7.8	700	8.6	1,250	11.0	1,700	11.2
Manufacturing	352	4.9	340	4.2	400	3.5	1,000	6.6
Transportation-Utilities	549	7.6	590	7.2	625	5.5	750	4.9
Wholesale Trades	206	2.9	215	2.6	260	2.3	360	2.4
Retail Trades	1,271	17.7	1,650	20.2	1,850	16.2	2,700	17.8
Services	1,278	17.8	1,400	17.2	1,900	16.7	2,800	18.4
Contractors	501	7.0	665	8.1	1,260	11.0	1,000	6.6
Local Government	410	5.7	470	5.8	675	5.9	860	5.6
State-Federal Government	375	5.2	475	5.8	590	5.2	690	4.5
All Other Employed	322	4.5	305	3.7	490	4.3	750	4.9
Unemployed	370	5.1	400	4.9	450	3.9	590	3.9
TOTALS	7,193	100.0	8,160	100.0	11,400	100.0	15,200	100.0

1/ Data applicable to San Juan and LaPlata Counties, Colorado only.

trades, services and government remain the major employment sectors of the economy throughout the 50-year projection period. Slight declines in number employed in agriculture, manufacturing and "all other" employed categories are expected from 1960 to 1965. All sectors are expected to show increases in number employed from 1965 to 1980. From 1980 to 2010, slight declines in number of persons employed in agriculture and construction are expected while moderate employment increases are projected in minerals, manufacturing, trades and service categories.

Employment projections for the study area, compared with projections for Colorado, the Mountain States Region [1/] and the United States for 1976 and 2000 are shown in Table 42. Agriculture's share of total employment shows a steady decline in all areas throughout the 1960-2000 projection period. The number of employees in agriculture, however, is expected to increase slightly by 1976 in the study area as compared to an expected decrease by 1976 in Colorado, the Mountain States Region and the United States. The study area remains stable from 1976 to 2000 as compared to an expected increase in number employed by agriculture in the other areas during this period.

It is noted that trades, services and government remain the major employment sectors of the economy throughout the projection period in all areas. Mining, however, is expected to be a major employment sector in the study area increasing from 11.7 percent of total employment in 1960 to 19.4 percent in 2000. The number employed in manufacturing is expected to increase throughout the projection period in all areas, but manufacturing will have a declining share of total employment, except for the study area, due to projected high employment increases in the trades and service divisions.

[1/] Includes Colorado, Idaho, Montana, Utah and Wyoming

Table 42. Distribution of Civilian Employment by Major Industry Divisions for the Animas-LaPlata Study Area1/ compared with the State of Colorado, the Mountain States Region, and the United States, 1960 with projections for 1976 and 2000.

Employment Division	Animas - LaPlata Study Area						State of Colorado						Mountain States Region						United States (Thousands of persons)					
	1960		1976		2000		1960		1976		2000		1960		1976		2000		1960		1976		2000	
	Number of Employees	% Total Employed	Number of Employees	% Total Employed	Number of Employees	% Total Employed	Number of Employees	% Total Employed	Number of Employees	% Total Employed	Number of Employees	% Total Employed	Number of Employees	% Total Employed	Number of Employees	% Total Employed	Number of Employees	% Total Employed	Number of Employees	% Total Employed	Number of Employees	% Total Employed	Number of Employees	% Total Employed
Agriculture	758	11.1	832	8.2	833	6.2	48,660	7.7	41,600	4.4	NA	NA	168,355	11.1	159,600	7.7	198,000	5.9	5,800	8.7	4,600	5.0	5,200	3.8
Mining	801	11.7	1,735	17.2	2,605	19.4	14,250	2.3	16,000	1.7	NA	NA	47,282	3.1	50,000	2.4	50,400	1.5	600	.9	700	.8	700	.5
Manufacturing	352	5.2	384	3.8	800	6.0	98,887	15.8	121,800	13.0	NA	NA	211,471	14.0	232,700	11.2	350,000	10.4	16,900	25.5	22,000	24.0	25,400	18.8
Trans-Utilities	549	8.0	615	6.1	708	5.3	49,948	8.0	58,400	6.2	NA	NA	125,586	8.3	136,100	6.5	154,000	4.6	4,800	7.2	5,200	5.7	6,000	4.4
Trades	1,477	21.6	2,045	20.3	2,745	20.5	127,900	20.4	238,000	25.3	NA	NA	305,321	20.2	505,300	24.2	918,300	27.4	12,900	19.4	20,600	22.6	34,800	25.7
Services	1,278	18.7	1,765	17.5	2,495	18.6	117,718	18.8	214,800	22.9	NA	NA	262,166	17.3	462,300	22.2	886,700	26.5	11,900	17.9	20,200	22.0	34,500	25.4
Construction	501	7.4	1,095	10.8	1,085	8.1	44,179	7.0	73,800	7.9	NA	NA	106,974	7.1	163,700	7.8	202,600	6.0	3,800	5.7	6,100	6.6	7,600	5.6
Government	785	11.6	1,180	11.7	1,455	10.9	74,483	11.9	140,800	15.0	NA	NA	183,691	12.1	307,800	14.8	477,700	14.2	6,800	10.3	8,900	9.7	16,300	12.0
Finance & Other	322	4.7	440	4.4	665	5.0	50,744	8.1	34,200	3.6	NA	NA	103,012	6.8	67,000	3.2	115,800	3.5	2,900	4.4	3,500	3.8	5,200	3.8
Total Employment	6,823	100.0	10,091	100.0	13,391	100.0	626,769	100.0	939,400	100.0	NA	NA	1,513,856	100.0	2,084,500	100.0	3,353,500	100.0	66,400	100.0	91,800	100.0	135,700	100.0

1/ Data limited to San Juan and LaPlata Counties, Colorado

Source: 1960 Census of Population; ORRRC, Study Report No. 23, projections to the years 1976 and 2000, op. cit. and projections by the authors.

Manufacturing employment in the study area as a percentage of total employment is expected to decrease from 1960 to 1976; however, a sizable increase is expected from 1976 to 2000. The trades and services share of total employment in the study area remains relatively constant throughout the projection period.

Summary

Population growth in the study area is expected to proceed at a more rapid rate than Colorado and the Mountain States Region throughout the 50-year projection period. It is expected to exceed the United States rate until the year 2000. By 2010, the population of the study area is expected to increase to 43,000 compared to 20,074 in 1960. The percentage of the population residing in Durango is expected to increase from 55 percent in 1960 to 71 percent in 2010. The percentage accounted for by rural farm and non-farm residents is expected to increase slightly from 1960 to 1980 and to decline from 1980 to 2010.

The total labor force is expected to increase from 7,193 persons in 1960 to 15,200 in 2010. The population/labor force ratio is expected to be 2.94 in 1965, 2.85 in 1980 and 2.83 in 2010, compared to 2.79 in 1960. Unemployment is expected to drop from 5.1 percent of the labor force in 1960 to 3.9 percent in 1980 and 2010. Increases in number of persons employed are expected in each industry category from 1965 to 1980. Slight declines are expected, however, in agriculture and construction from 1980 to 2010. Moderate increases in mineral industries, manufacturing, trades and services are expected during the next 50 years, particularly in the period from 1980 to 2010.

Gross Regional Product and Realized Personal Income

The study area's production of goods and services, (Gross Regional Product) was estimated to be approximately $38.2 million in 1960. By 1965, it is expected to have risen to $49.4 million, while by 1980 it is expected to be $91.0 million and by 2010, $182.0 million. (These estimates are stated in terms of the 1960 price level; if price increases occur, the projected output would be correspondingly higher.) The projected output increase for the study area is more rapid than the projected national increase but consistent with the National Planning Association view: "The regions in which output is expected to increase faster than the national average are New England, the Southeast, the Southwest, the Mountains and the Far West". 1/

Realized personal income is expected to rise from approximately $33.1 million in 1960 to $49.5 million in 1965, to $82.3 million in 1980 and to $129.0 million in 2010. The expected increase in personal income of 60 percent from 1960 to 1980 compares favorably with a projected increase of 50 percent in per capita disposable income on a national basis during the 1960-1976 period. 2/

It should be noted that the projected rate of growth for the study area's economy is considerably higher than either the national or the local growth rate experienced in the past. GNP for example, has risen at an average of about 3 percent per year since 1900 and is projected at an average of 3.5 percent annually for the period 1960-2000. 3/ The expected increase in the study area's rate of growth can best be identified by taking a look at the probable sources of economic growth during the next 50 years. A brief summary of the probable situation for 1965, 1980 and 2010 is therefore

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1/ ORRRC, Projections to the Years 1976 and 2000, op cit.
2/ Ibid
3/ Ibid

provided below. Less detail is shown for 1980 and 2010 than for 1965 because of the extreme uncertainty involved in developing long-range projections.

Forecast of the 1965 Economy

The study area's Gross Regional Product, or its final production of goods and services, is expected to rise from approximately $38.2 million in 1960 to $49.4 million in 1965--an increase of about 29 percent (Table 43). Personal income is expected to increase about 19 percent--from $33.1 million in 1960 to $39.5 million in 1965. The forecasted sources of basic income and their contribution to the area's economic growth are shown in Table 44.

An over-all growth in commercial activity of 32.4 percent from the 1960 level is forecasted for 1965. Retail sales are expected to increase by about 33.3 percent and general service sales by about 31.4 percent. The study area is expected to become more dependent upon travelers (recreational activity) and State-Federal Government activity by 1965 (as can be determined by a comparison of Figure 28 which shows expected origin of commercial activity in 1965, and Figure 12 which shows the 1960 situation).

Figure 28 shows, in addition, the expected relative importance of basic income sources to the various components in the commercial sector of the local economy. In terms of the specific industries identified, the oil, gas and other minerals industry was the most important with basic income of $12,127,000 originating from this activity. The retail sector followed with $10,985,000 total basic income produced in its' sales to travelers. State-Federal Governments contributed $6,840,000 by their direct payments and purchases in the local area. Manufacturing, transportation-utilities and construction activities produced approximately the same, or slightly smaller, proportions of total basic income in 1965 compared to 1960, and therefore declined slightly in their importance to total commercial activity.

Table 43. Projection of Gross Regional Product, Animas-LaPlata Study Area, 1965, Compared with 1960. 1/

Source	1960		1965	
	Amount ($1,000's)	Percent	Amount ($1,000's)	Percent
HOUSEHOLD SECTOR				
Personal Consumption Expenditures	23,644	61.8	28,300	57.3
Durable Goods	8,512	(22.3)	6,715	(13.6)
Non-Durable Goods	10,404	(27.2)	14,030	(28.4)
Services	4,728	(12.3)	7,555	(15.3)
BUSINESS SECTOR				
Gross Private Domestic Investment	4,223	11.0	7,850	15.9
New Construction	3,329	(8.7)	6,175	(12.5)
Producer's Durable Equipment	894	(2.3)	1,675	(3.4)
Change in Business Inventories	-	-	-	-
OUT-OF-REGION SECTOR				
Net Export of Goods and Services	1,635	4.3	1,250	3.4
GOVERNMENT SECTOR				
Government Purchases of Goods and Services	8,733	22.9	12,000	24.3
State and Federal	5,389	(14.1)	7,650	(15.5)
Local	3,344	(8.8)	4,350	(8.8)
GROSS REGIONAL PRODUCT	38,235	100.0	49,400	100.0

1/ Data limited to San Juan and LaPlata Counties, Colorado

Source: Estimates by the Authors

Table 44. Projected Sources of Basic Income and Its Effect on Various Sectors of the Economy, Animas-LaPlata Study Area, 1965 [1]

($1,000's)

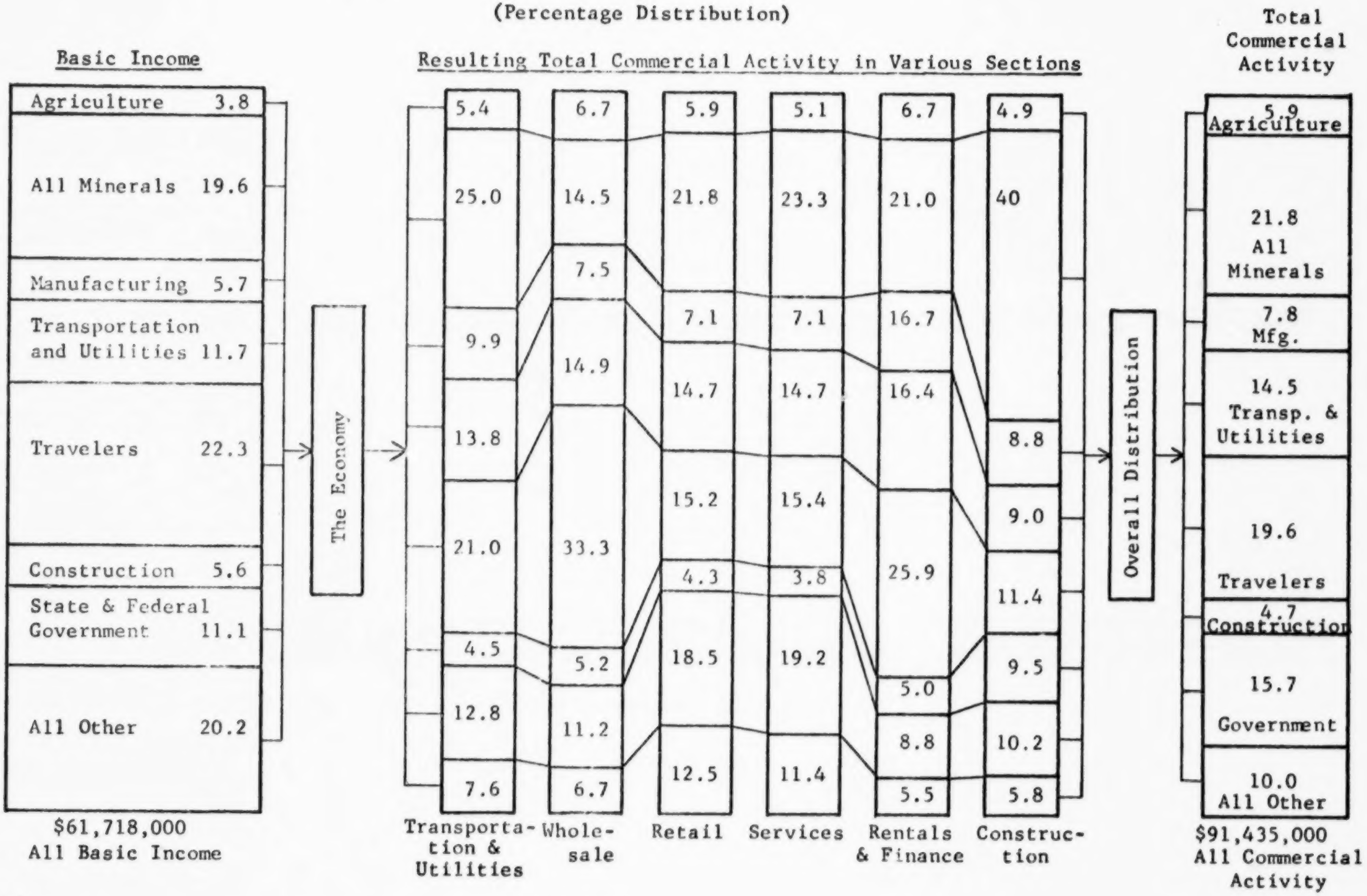
	AGRICULTURE		OIL & GAS		OTHER MINERALS		MANUFACTURING		TRANS-UTILITIES		TRAVELERS		CONSTRUCTION		STATE-FEDERAL GOVT.		ALL OTHER		GRAND TOTALS	
	Export Value	Produced Business	Export Value	Produced Business	Export Value	Produced Business	Export Value	Produced Business	Export Value	Produced Business	Export Value	Produced Business	Export Value	Produced Business	Purchases (Direct)	Produced Business	Export Value	Produced Business	Basic Income	Produced Business
1. Agriculture	2,370	232		36		35		593		114		111		24	552	173		79	2,922	1,397
2. Minerals		45	4,565	298	7,562	171		80		905		172		36		157		95	12,127	1,959
3. Manufacturing		80		146		144	3,526	89		168		380		94		251		165	3,526	1,517
4. Trans. & Utilities		313		526		910		571	7,216	791		1,205		257	29	737		435	7,245	5,745
5. Wholesale		584		612		641		652		1,294		2,888		453	196	972	7,830	582	8,026	8,678
6. Retail		1,432		2,481		2,774		1,706		3,554	10,985	3,673	1,171	1,036	36	4,447		3,010	12,192	24,113
7. Services		260		670		512		358		744	2,747	778	80	195	6	972	8	579	2,841	5,068
8. Rentals & Finance		168		282		245		269		410		650		125	15	221	1,740	138	1,755	2,508
9. Contractors		107		203		678		192		196		249	2,210	207	11	223		128	2,221	2,183
10. Local Government															1,629				1,629	
11. Household Consumption															4,366		2,868		7,234	
TOTALS	2,370	3,221	4,565	5,254	7,562	6,110	3,526	4,510	7,216	8,176	13,732	10,106	3,461	2,427	6,840	8,153	12,446	5,211	61,718	53,168
Business Generator	1.359		1.151		.808		1.279		1.133		.736		.701		1.192		.388			.861
Local Gov. Revenue		356		293		377		207		633		452		96		2,281*		445		5,140*
State Fed. Revenue		362		781		606		805		1,193		1,592		302		1,650		2,674		9,965
Personal Income Generator	.8110		.8733		.5992		.7330		.7917		.3956		.4080		1.1047		.5107			.6352
Realized Personal Income		1,922		3,987		4,531		2,585		5,713		5,432		1,412		7,556*		6,335*		39,473*

[1] Limited to San Juan and LaPlata Counties
* Includes both basic and produced income

Source: Estimates by the Authors

Figure 28 - Projection of Basic Income Origin of Commercial Activity by Commercial Firms, Animas-La Plata Study Area, 1965 1/

(Percentage Distribution)


Basic Income
Agriculture 3.8
All Minerals 19.6
Manufacturing 5.7
Transportation and Utilities 11.7
Travelers 22.3
Construction 5.6
State & Federal Government 11.1
All Other 20.2
$61,718,000 All Basic Income
The Economy
Resulting Total Commercial Activity in Various Sections
Transportation & Utilities
5.4
25.0
9.9
13.8
21.0
4.5
12.8
7.6
Wholesale
6.7
14.5
7.5
14.9
33.3
5.2
11.2
6.7
Retail
5.9
21.8
7.1
14.7
15.2
4.3
18.5
12.5
Services
5.1
23.3
7.1
14.7
15.4
3.8
19.2
11.4
Rentals & Finance
6.7
21.0
16.7
16.4
25.9
5.0
8.8
5.5
Construction
4.9
40
8.8
9.0
11.4
9.5
10.2
5.8
Overall Distribution
Total Commercial Activity
5.9 Agriculture
21.8 All Minerals
7.8 Mfg.
14.5 Transp. & Utilities
19.6 Travelers
4.7 Construction
15.7 Government
10.0 All Other
$91,435,000 All Commercial Activity

1/ Data limited to San Juan & La Plata Counties, Colorado

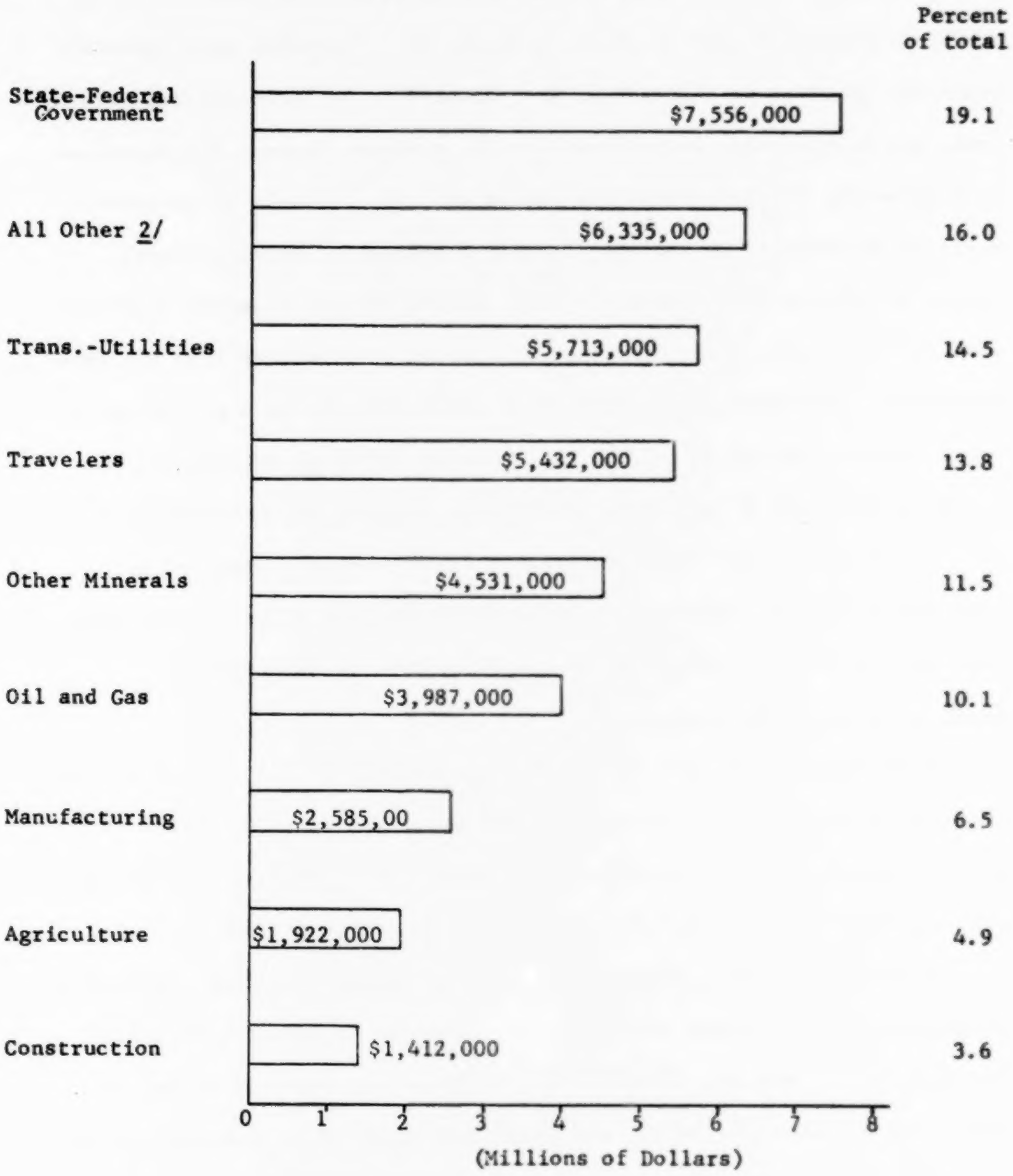
The contribution of the various local industry components to total realized personal income is shown in Figure 29. The three most important segments, in order of importance, are expected to be State-Federal Government, All Other (which includes wholesale, rentals, finance and miscellaneous sources), and Transportation-Utilities. The reliance on government activity is expected to increase from 18.3 percent of total personal income in 1960 to 19.1 percent in 1965. Travelers are expected to become more important than Other Minerals--a reversal of positions from the 1960 situation. Construction is expected to contribute the same percentage to total personal income as in 1960, 3.6 percent, although an absolute increase of $231,000 is expected, and will be the smallest contributor of the various industries listed. Agriculture and manufacturing are both expected to be less important to personal income generation in 1965 than they were in 1960, although only a slight decline is anticipated.

Forecast of the 1980 Economy

Gross regional product is expected to increase to $91 million in 1980 compared to $49.4 million in 1965 and $38.2 million in 1960. (Table 45). Realized personal income is expected to increase to $82.3 million in 1980 compared with $39.5 million in 1965 and $33.0 million in 1960.

An estimate of the proportion of realized personal income expected to be generated from various sources of basic income is shown in Figure 30. The three major sources, in order of importance are expected to be: All Other, State-Federal activity, and Travelers, which when combined are expected to account for over half of total realized personal income. Major changes in position of the sources of realized personal income, from 1965 to 1980 include a drop in Transportation-Utilities from the number three

Figure 29. Projection of Realized Personal Income Attributable to Various Sources of Basic Income, Animas-LaPlata Study Area, 1965. 1/



1/ Data limited to San Juan and LaPlata Counties, Colorado.
2/ Includes rentals and finance, wholesale and miscellaneous sources.

Source: Estimates by the authors.

Table 45. Projected Sources of Basic Income and Its Effect on the Local Economy, Animas-LaPlata Study Area, 1980 1/

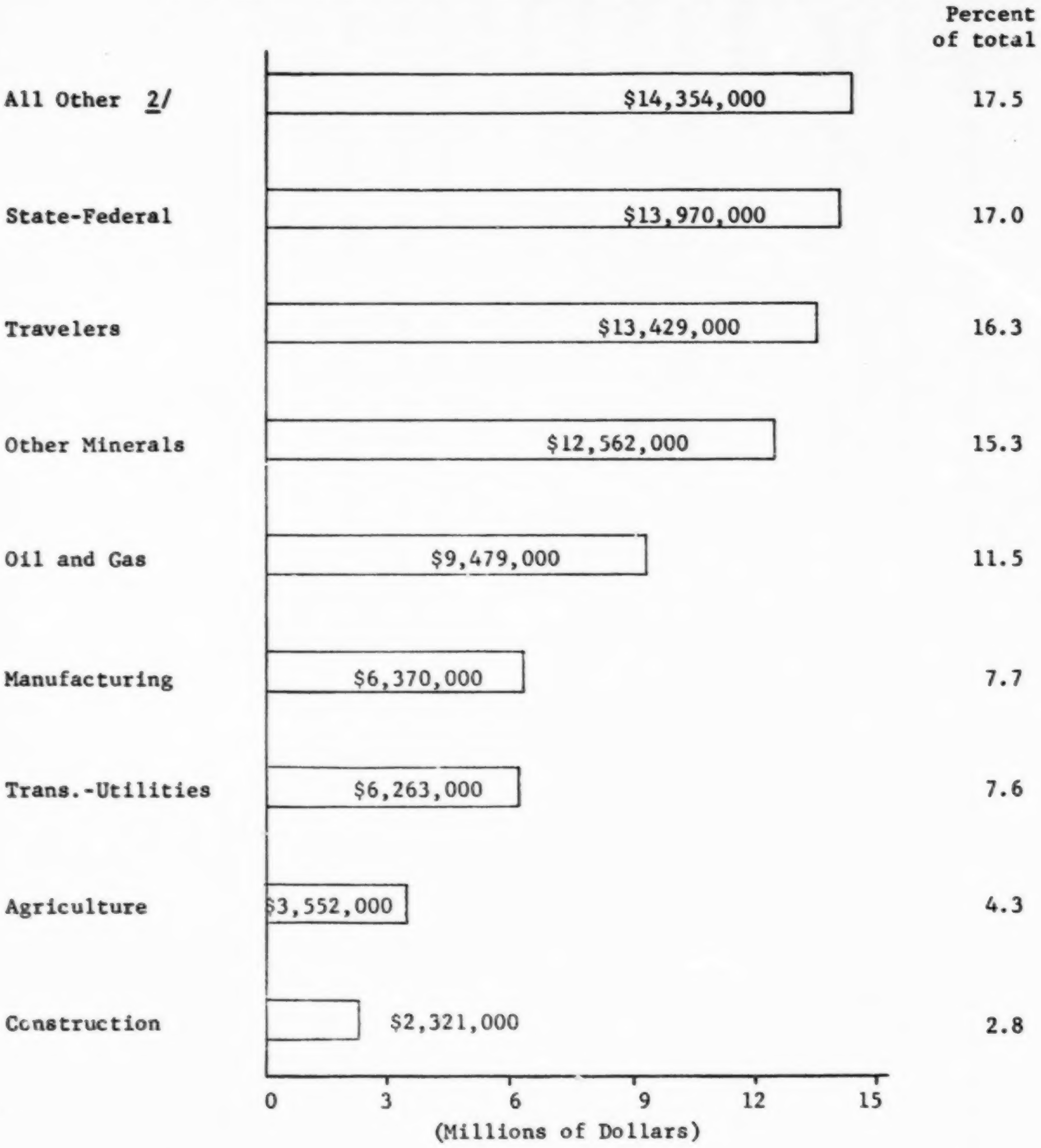
	Agri- culture	Oil- Gas	Other Minerals	Manuf.	Trans.- Util.	Trav- elers	Constr.	State- Federal	All Other	Grand Totals
					($ 1,000's)					
Gross Regional Product	-	-	-	-	-	-	-	-	-	91,000
Basic Income	4,440	15,960	20,150	7,900	7,300	31,500	6,400	12,700	20,000	126,350
Produced Business	5,949	12,496	16,946	11,115	8,957	24,538	5,376	15,075	10,900	111,352
Realized Personal Income	3,552	9,479	12,562	6,370	6,263	13,429	2,321	13,970*	14,354*	82,300*
Local Government Revenue										8,300*
State-Federal Revenue										16,600
Business Generator	1.3400	.7830	.8410	1.4070	1.2270	.7790	.8400	1.1870	.5450	.8813
Personal Income Generator	.8000	.5939	.6234	.8063	.8579	.4263	.3627	1.1000	.7177	.6514

1/ Data limited to San Juan and LaPlata Counties, Colorado

* Includes both basic and produced income.

Source: Estimates by the authors.

Figure 30. Projection of Realized Personal Income Attributable to Various Sources of Basic Income, Animas-LaPlata Study Area, 1980. 1/



1/ Data limited to San Juan and LaPlata Counties, Colorado.
2/ Includes wholesale, rentals, finance and miscellaneous sources.

Source: Estimates by the authors.

position to number seven; a move upward for Travelers from number four to number three; and a move upward for Manufacturing from number seven to number six. Likewise, it should be noted that the percentage contribution of Agriculture and Construction to total realized personal income is expected to decline, in spite of large anticipated increases in total activity in both sectors.

Forecast of the 2010 Economy

Gross regional product in 2010 is expected to be approximately $182 million, a doubling of the 1980 projected level and almost a five-fold increase from the 1960 level (Table 46). Realized personal income in 2010 is expected to be approximately $129 million or 3.9 times the 1960 level.

A projection of realized personal income attributable to various sources in 2010 is shown in Figure 31. Considerable reorientation of the various industries is anticipated as can be seen by comparing Figure 31 with Figure 14--the 1960 situation and Figures 29 and 30 which show anticipated situations in 1965 and 1980. Note for example, that the Travelers category, which represents primarily recreational activity, is expected to move from number 5 position in 1960 (where it contributed 9.8 percent of total realized personal income) to number one position in 2010 where it is expected to contribute 17.7 percent. Manufacturing is also to increase tremendously in importance, rising from the number seven position in 1960, (where it contributed 6.9 percent) to number two position in 2010 where it is expected to contribute 17.5 percent. The role of Agriculture as a contributor to total realized personal income is expected to drop from 5.7 percent in 1960 to 1.8 percent in 2010. Other changes can be ascertained from a study of the four Figures mentioned above. All in all, it should be

Table 46. Projected Sources of Basic Income and Its Effect on the Local Economy, Animas-La Plata Study Area, 2010 1/

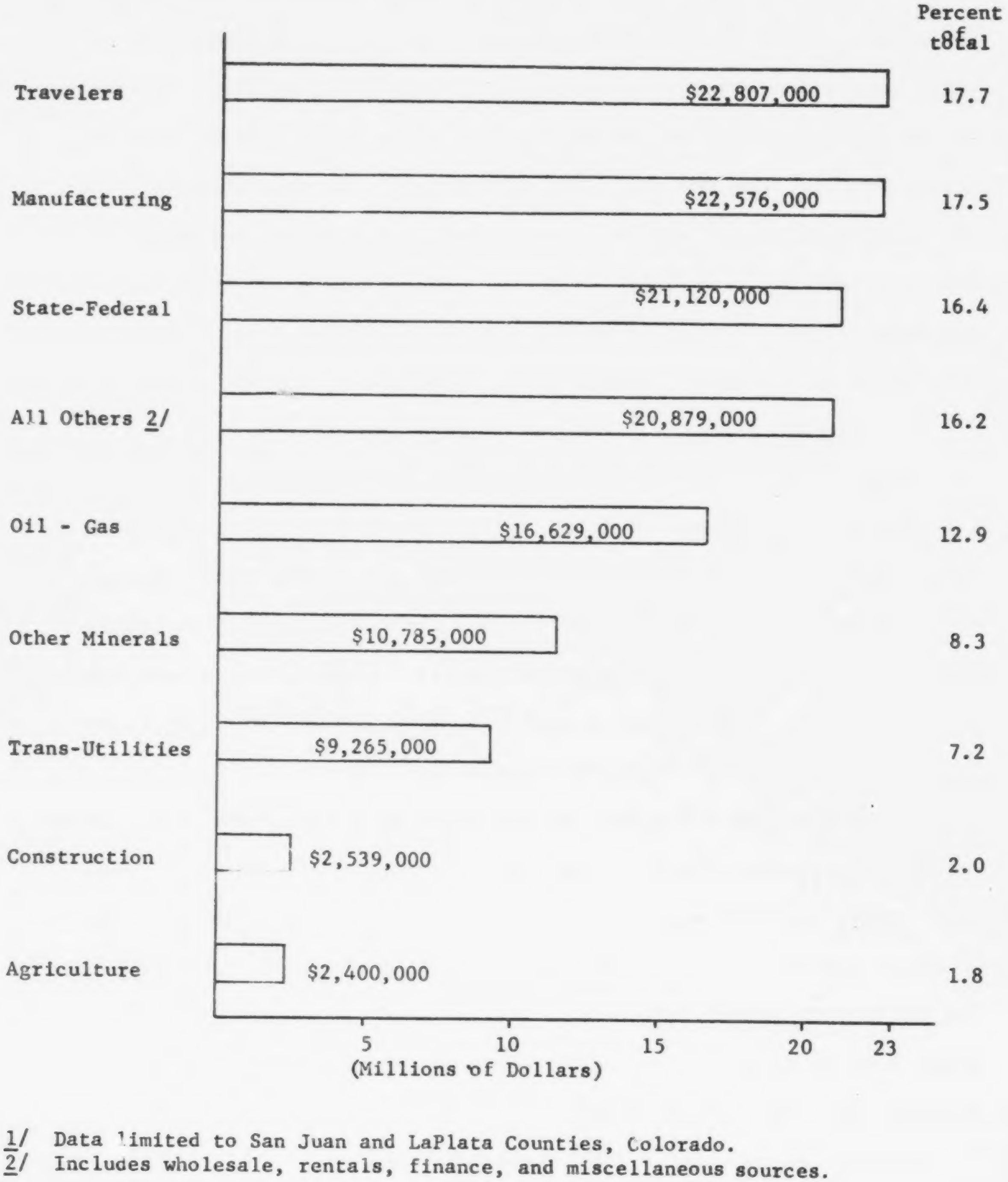
	Agri-culture	Oil-Gas	Other Minerals	Manuf.	Trans.-Util.	Trav-elers	Constr.	State-Federal	All Other	Grand Totals
				($ 1,000's)						
Gross Regional Product	-	-	-	-	-	-	-	-	-	182,000
Basic Income	3,000	28,000	17,300	28,000	10,800	53,500	7,000	19,200	29,100	195,900
Produced Business	4,020	21,924	14,549	39,396	13,252	41,676	5,880	22,790	15,859	179,346
Realized Personal Income	2,400	16,629	10,785	22,576	9,265	22,807	2,539	21,120*	20,879	129,000*
Local Government Revenue										13,800*
State-Federal Revenue										25,500
Business Generator	1.3400	1.7830	.8410	1.4070	1.2270	.7790	.8400	1.1870	.5450	.9155
Personal Income Generator	.8000	.5939	.6234	.8063	.8579	.4263	.3627	1.1000	.7175	.6585

1/ Data limited to San Juan and LaPlata Counties, Colorado.

* Includes both basic and produced income.

Source: Estimates by the authors.

Figure 31. Projection of Realized Personal Income Attributable to Various Sources of Basic Income, Animas-LaPlata Study Area, 2010. 1/



1/ Data limited to San Juan and LaPlata Counties, Colorado.
2/ Includes wholesale, rentals, finance, and miscellaneous sources.

Source: Estimates by the authors.

stressed that if these assumed growth rates are correct, water quality considerations important to the Recreation and Manufacturing segments of the economy should be given utmost consideration in the development of a water quality management plan for the Animas-LaPlata Study Area. Inversely, the pollution effects of declining segments of the local economy, such as Agriculture and Other Minerals, must also be given due consideration, from the standpoint of their possible constraining effect on the growth of Recreation and Manufacturing. Not to be ignored, however, will be the overall municipal requirements and those of other industries required for the development of a balanced economy in the study area during the next 50 years.

Possible Variations in the Projected Growth Path

Three major factors can be pinpointed as most likely to be responsible for the future development of an economy in the study area which would differ from that projected in the previous section: These are: 1) Changes in the projected national economy which would affect the supply and demand aspects of products from industries in the local area; 2) Future development sequence of various industries in the study area; and 3) Water quality and quantity constraints on future development.

Slight variations from the assumed situation in any of the three factors mentioned above will result in significant changes in the projected growth path. These possible variations are not discussed in detail in this report. A look at possible variations will be included, however, at a later date in the development of alternative water quality management plans for the Colorado River Basin. Let it suffice here to comment only briefly on the possible magnitude of such changes.

A change in national policy in regard to future agricultural development, for example, would have far reaching significance. The probable projected growth path assumes that the proposed Bureau of Reclamation projects will be developed on schedule and that their estimates of agricultural development resulting from this will be realized. If these projects are delayed, however, or if a change in allocation of the water to be stored were made, then agricultural activity would be vastly different than projected in the previous section. Likewise, expansion of the manufacturing activity would proceed at a faster rate and doubtless along different lines than projected above.

Consider also the probable impact of an increase in the price of gold, say to $40 an ounce, within the near future. Mining activity would be immediately reactivated on a major scale in the study area and this in turn would have a direct impact on the other major sectors of the local economy. Likewise, major changes in demand for other minerals, say as a direct result of a change in national defense needs, would have a similar impact of significant proportions.

The above developments, and others of a similar nature, would of course, have a direct bearing on which sectors of the economy would proceed to grow rapidly. A change in the sequence of when various industries are expected to expand would in turn have an effect on which industries could subsequently be expected to expand. This would be due in part to which industries provide raw material and development impetus for others, and perhaps even more because of their impact on the water quality and quantity aspects of the local water resource.

Summary for Part IV

Part IV provides a projection of the probable economy of the Animas-LaPlata study area for the 50-year period, 1960-2010. This is based on a set of assumptions set forth in the Introduction to this report and on a judgement evaluation of the resource base of the area and the likelihood of its development by various sectors of the local economy. Major items in these forecasts, including population, labor force, employment and monetary returns are summarized in Table 47.

Variations in the future growth path from those projected are not only possible but extremely likely. The probability of deviation increases as one moves further into the future. For this reason, the 1980 and 2010 projections can give only an indication of probable degrees of magnitude. Even the relatively short range forecasts to 1965, shall be deemed extremely vulnerable to national and regional changes in the economy, as well as unforseen local motivations that may well develop which would change the actual 1965 situation from that which has been projected. In other words, these appearances of precision contained in the 50-year forecasts are designed solely for planning purposes and are not to be interpreted as reliable indicators of the short-run situation. The point to emphasize here is that the foregoing analysis provides a framework by which more reliable projections may be made in the future as additional data becomes available.

Table 47. Summary of Economic Projections for the Animas-LaPlata Study Area, 1960 - 2010. 1/

	Animas-LaPlata Study Area			
Item	Millions of Dollars		Ratio of Projected Year Values to 1960 Values	
	1960	1965	1980	2010
Gross Regional Product	38.3	49.4	2.38	4.75
Gross Product Per Capita 2/	1,905	2,060	1.47	2.22
Household Expenditures	23.6	28.3	NA	NA
Personal Expenditures Per Capita 2/	1,178	1,179	NA	NA
Government Expenditures	8.7	12.0	NA	NA
Government Revenues	11.0	15.1	2.26	3.57
Personal Income	33.1	39.5	2.48	3.90
Personal Income Per Capita 2/	1,648	1,645	1.54	1.82
	Number of Persons		Ratio of Projected Year Estimate to 1960	
Population	20,074	24,000	1.62	2.14
Ratio-population/Labor Force	2.79	2.94	1.02	1.015
Total Labor Force	7,193	8,160	1.59	2.11
Civilian Labor Force	7,193	8,160	1.59	2.11
Average Weekly Hours	40.5	40.0	0.9	0.8
Civilian Employment	6,823	7,760	1.61	2.14
Agriculture	758	650	1.19	1.06
Mining	801	1,000	2.50	3.62
Manufacturing	352	340	1.14	2.84
Trans.-Utilities	549	590	1.14	1.37
Trades	1,477	1,865	1.43	2.07
Services	1,278	1,400	1.49	2.19
Construction	501	665	2.52	2.00
Finance and Other	322	305	1.52	2.33
Government	785	945	1.61	1.98
Unemployment	370	400	1.22	1.59

1/ Data limited to San Juan and LaPlata Counties, Colorado
2/ Value stated in dollars rather than millions of dollars.

Source: 1960 Census of Population and projections by the authors.

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APPENDIX A

EXPLANATION OF THE INPUT-OUTPUT MODEL 1/

Total output (sales) by an industry over a particular time period equals the sum of its output going to each local industry plus the output going to industries outside the local economy. If there are n local industries, this statement may be written symbolically as:

(1) $X_i = \Sigma_j x_{ij} + y_i \qquad (i,j = 1,2,.....,n)$

Where: X_i = total output (sales) by industry i

x_{ij} = output (sales) from industry i to industry j within local economy

y_i = output going outside the local economy

Table 34 in Part III, showing the flows of output (sales) between the local industries and to the "outside world," is simply the quantification of equation (1) for the Animas-LaPlata study area. The processing sector represents the x_{ij}'s, the export sector the y_i's, and the total at the right the X_i's.

By assuming that purchases by each industry has a constant relationship to output by that industry, equation (1) can be converted to a very useful model. Table 35 in Part III shows these relationships for the study area. That is, assume:

(2) $x_{ij} = a_{ij}X_j \qquad (i,j = 1,2,.....,n)$

Total output as expressed in equation (1) becomes:

(3) $X_i = \Sigma_j a_{ij}X_j = y_i$

or

(4) $y_i = X_i - \Sigma_j a_{ij}X_j \qquad (i,j = 1,2,.....,n)$

1/ The assistance of Mr. Richard E. Lund, Research Associate at the University of Wyoming, is gratefully acknowledged in the preparation of this technical supplement.

Equation (4) in matrix notation can be written as:

(5) $Y = X - AX$

or

(6) $Y = (I - A) X$

To make this model useful it is valuable to manipulate equation (6) so that total output for a predictive period is a function of export for that period. Thus, under the condition that $(I - A)$ has an inverse, equation (6) becomes:

(7) $X = (I - A)^{-1} Y$

The $(I - A)^{-1}$ matrix for the study area is included as Table 36. Each element of the inverse matrix may be regarded as representing the amount of output from industry i used both directly and indirectly per dollar of export by industry j.

A new Y and/or a new X was developed from outside data for making the forecast for 1965. Ideally, however, a new Y can best be estimated for the forecast. In cases where this is not true, X and Y are generally sufficiently closely related so that Y can be estimated from X. The new Y should then be multiplied by the $(I - A)^{-1}$ matrix for 1960 to obtain total expected output for each industry in 1965.

The forecasts for 1980 and 2010 were also developed from outside data. They were then multiplied by an adjusted columnsum of the $(I - A)^{-1}$ matrix for 1960 (i.e. the business generator) to obtain total expected output for each industry. Here again, in order to make full use of the model the new Y for 1980 and 2010 should be multiplied by a corrected $(I - A)^{-1}$ matrix to obtain total expected output and its inter-relationships to the economy of the area.

The restriction that (I - A) have an inverse can be met if the Y vector contains at least one non-zero element in the year used in constructing the (I-A).

APPENDIX B

A DISCUSSION ON ERRORS AFFECTING THE MODEL [1/]

by
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In discussing the use of input-output models, in particular the models used herein, the author is frequently confronted with the comment: "I agree completely with the conclusions drawn from your model, but I'm suspicious as to the soundness of the data contained in it. I doubt that your sampling procedure would give you figures of required accuracy." Or in some cases: "I would like to construct a similar model, but neither our survey experience nor project budget will enable us to collect the immense amount of data required".

In answer to these comments the author submits that if proper attention is given to certain important classes of data required in constructing the model, and if sound sampling techniques are used for collecting data required to supplement the vast amount of secondary data available, the task of constructing such a model of sufficient accuracy to meet most research needs becomes feasible and can even be fitted into fairly small research budgets. In support of this statement and the models used in this study, the author contributes the following discussion concerning where accuracy should be strived for in input-output models.

[1/] This paper was originally prepared for inclusion in the following report: R.E. Lund, An Analysis of a Local Economy in a Period of Rapid Transition-Southwestern Wyoming, prepared by the University of Wyoming under the Small Business Administration Management Research Grant Program, scheduled for publication in the fall of 1962. It is included in the Animas-LaPlata study report with the permission of its author and that of Mr. Irving Maness, Deputy Administrator, Small Business Administration, Washington, D.C. as authorized in his letter of July 9, 1962.

For this short examination of the effects of certain kinds of errors, assume that an input-output model is to be constructed for an economy of quite similar size and structure to that of Southwestern Wyoming. 1/ Further, assume that economic activity in this economy can be summarized into only four industries; mining, utilities, trade, and household. While in reality an economy can never be quantified with 100 percent accuracy, there is nothing wrong with imagining such a situation to be possible. Thus, suppose that Table (I) represents this economy's interindustry table. All of the analyses could then be carried out and forecasts of future activity could be made upon expected changes in export activity.

For example, it may be determined from outside sources that this imaginary economy could be expected to increase its exports of utilities by five million dollars at some future time. What will be the effect of this increase on different local industries?

INTERINDUSTRY TABLE (I)
($millions)

-SALES-

PURCHASES

Industry	#1	#2	#3	#4	Export	Total
Mining (#1)	2	4	2	2	60	70
Utilities (#2)	4	1	5	5	5	20
Trade (#3)	3	2	10	25	30	70
Household (#4)	17	8	10	0	5	40
Import	44	5	43	8	0	100
Total	70	20	70	40	100	300

1/ The Animas-LaPlata study area is an example.

As noted in Appendix A, and as carried out for Southwestern Wyoming, an answer can be obtained by multiplying the inverse matrix by the column vector (0,5,0,0). While the inverse matrix is not shown here, the results of such a multiplication are shown in the third column of Table (II).

This identical use of the input-output model for this imaginary economy will now be repeated; however, an error will be inserted into the original 100 percent accurate table at various locations. After carrying out the required manipulations, the forecasting effect of these errors can be determined by comparing their forecasted total output to the total output derived by use of the error free model.

Assume now that an error of two million dollars was made in the purchasing column for utilities in the interindustry table so that two million dollars less was shown to be purchased from mining, and two million dollars more was shown to come from trade. This error amounting to 10 percent of total output for utilities of course would cause an error in the estimate of the effect on the economy from the additional five million dollars in export by utilities. By constructing a new input-output model including such an error in purchases, it was determined that the five million dollars in exports would produce \$13.5 million in business and personal income or only 2.5 percent less than was estimated by using the true model. These data are shown in Table (II).

It is interesting to assume a similar sized error in purchasing from minerals by utilities, but in contrast assume that this amount was then spent outside the economy instead of with the local trade industry. By building a model with this error incorporated, it was determined as shown

TABLE (II)

ERROR IN DETERMINING PRODUCED BUSINESS RESULTING FROM AN ERROR IN UTILITY PURCHASES

($millions)

Industry	Export Vector Applied	Correct Produced Output	CASE A			CASE B			CASE C		
			Purchases $	Output $	Error %	Purchases $	Output $	Error %	Purchases $	Output $	Error %
#1	0	1.49	4-2	.88	-40.9	4-2	.84	-43.6	4	1.40	- 6.0
#2	5	6.01	1	5.99	- 0.3	1	5.92	- 1.5	1	5.85	- 2.7
#3	0	3.12	2+2	3.51	+12.5	2	2.80	-10.2	2	2.43	-22.1
#4	0	3.21	8	3.11	- 3.1	8	2.97	- 7.5	8-2	2.44	-24.0
Totals		13.83		13.48	- 2.5		12.53	- 9.4		12.13	-12.3

in Table (II), that an error of 9.4 percent occurred in estimating the effect of a five million dollar additional export by utilities.

An error of two million dollars in the payroll sector of the utility industry resulted in an over-all error amounting to 12.3 percent for this same increase in utility exports. Data showing the individual errors occurring in the estimated effects of this five million dollar increase in exports are also shown in Table (II).

From these examples it may be deduced that an error of a given magnitude will have quite varying effects upon an input-output model according to its location. An error which changes the leakage picture is of considerable more concern than one resulting from assigning a local purchase to the wrong industry. Similarly, an error affecting household or any other industry having a high multiplier is of more concern than one with a low multiplier.

The above examples tend to over-emphasize the effects of an error for it is not often that only one type of export from an economy expands. To move to the opposite extreme, it may be assumed that the forecasted increase in exports is that all will increase by 50 percent. The new export column vector becomes 1.5(60, 5, 30, 5) where 1.5 is a scaler. Now if errors occur in constructing the processing sector of the model, but both total output and exports are 100 percent correct, the forecast will be 100 percent correct under the conditions assumed earlier despite that error.

Proof:

Assume the model: $X = Y\,(I - A)^{-1}$ Where: X = correct output
Y = correct export
$(I - A)^{-1}$ = matrix with or without an error

Then: $(1.5)X = (1.5)Y\,(I - A)^{-1}$ Where: 1.5 is a scaler.

It may also be proved in a similar manner to that above; that the condition of 100 percent accuracy in the original export picture can be relaxed somewhat without application errors becoming significant, providing the elements of the new export vector tend to be a constant proportion of the original elements (that is, if each original export can be assumed to increase by say, about 50 percent.)